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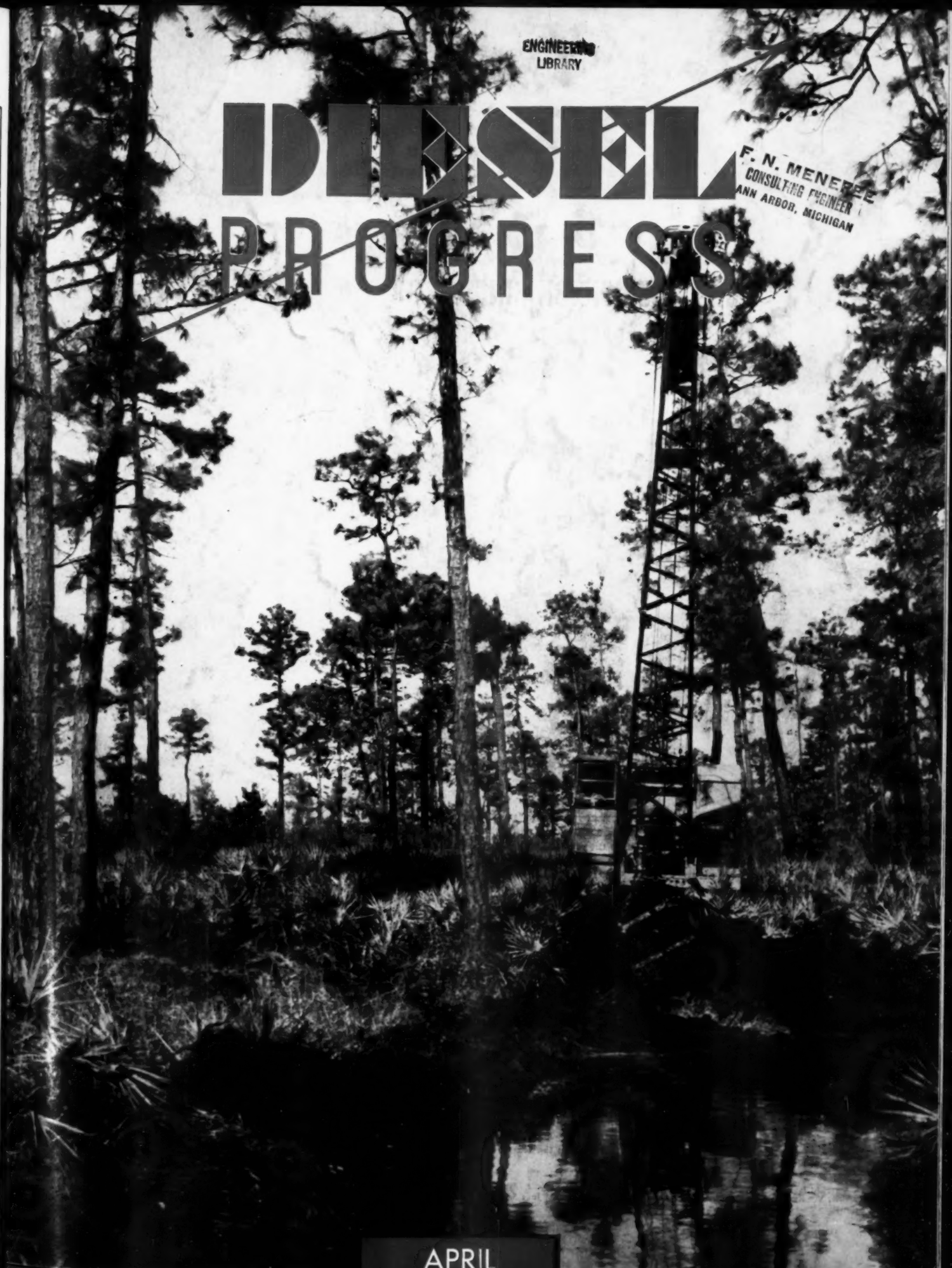

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DIESEL and GAS ENGINE PROGRESS

IN INDUSTRY • IN TRANSPORTATION • ON THE SEA • IN THE AIR

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FRONT COVER ILLUSTRATION: Near Orlando, Florida, water lurks within two feet of the surface—large areas are worthless swamps until drained. Here is seen a Koehring drag line, powered by a General Motors, 71-Series Diesel engine, at work on a drainage job. Land is being reclaimed for cattle pasture.

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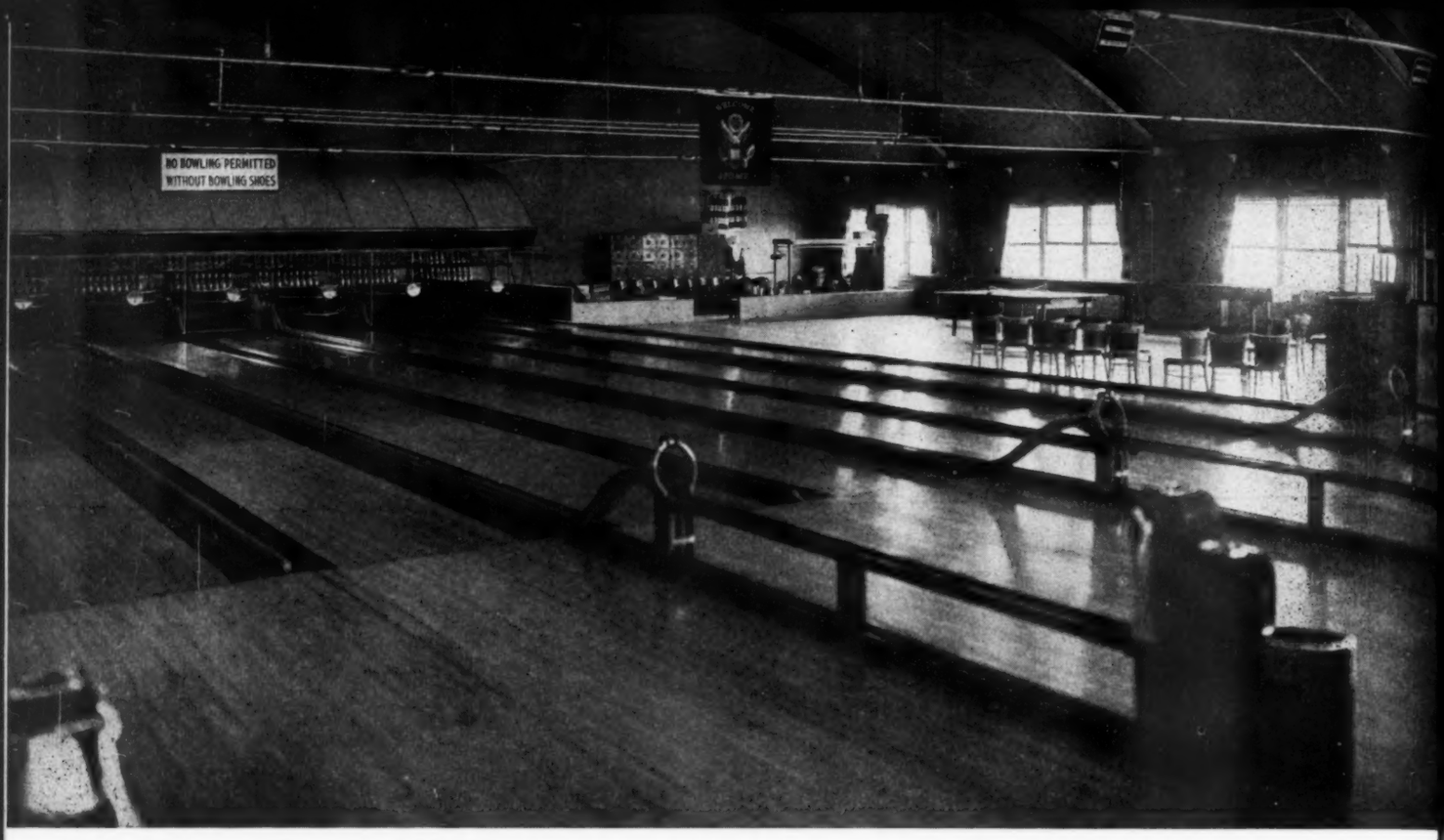
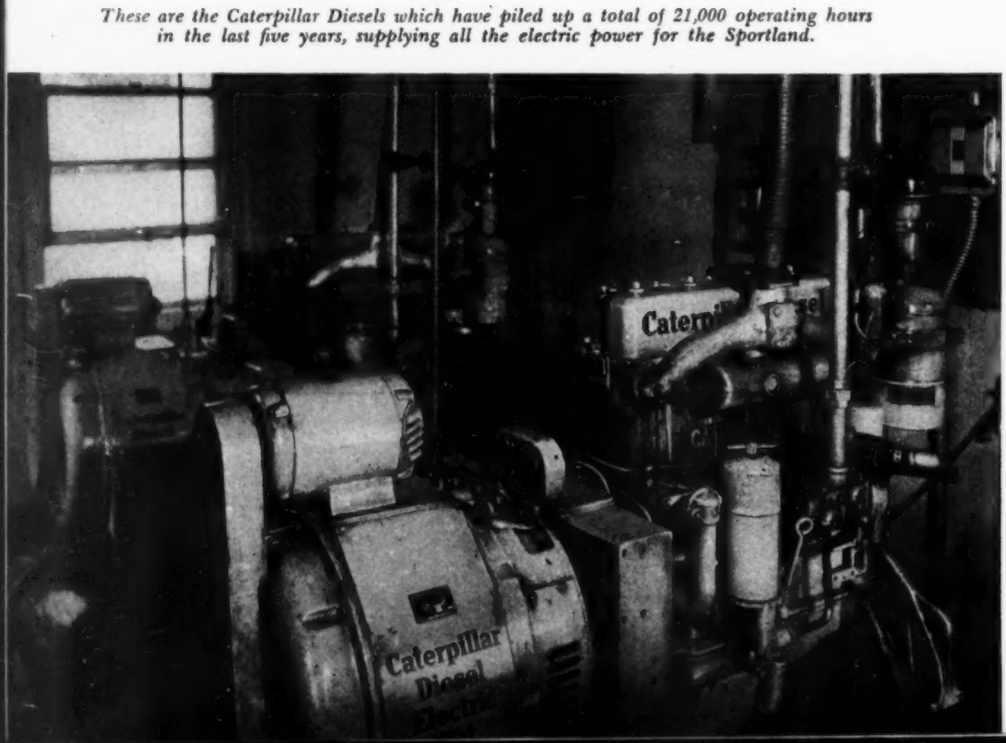


This spacious bowling alley along with other recreational facilities are supplied light and power by handy Diesel generating sets.

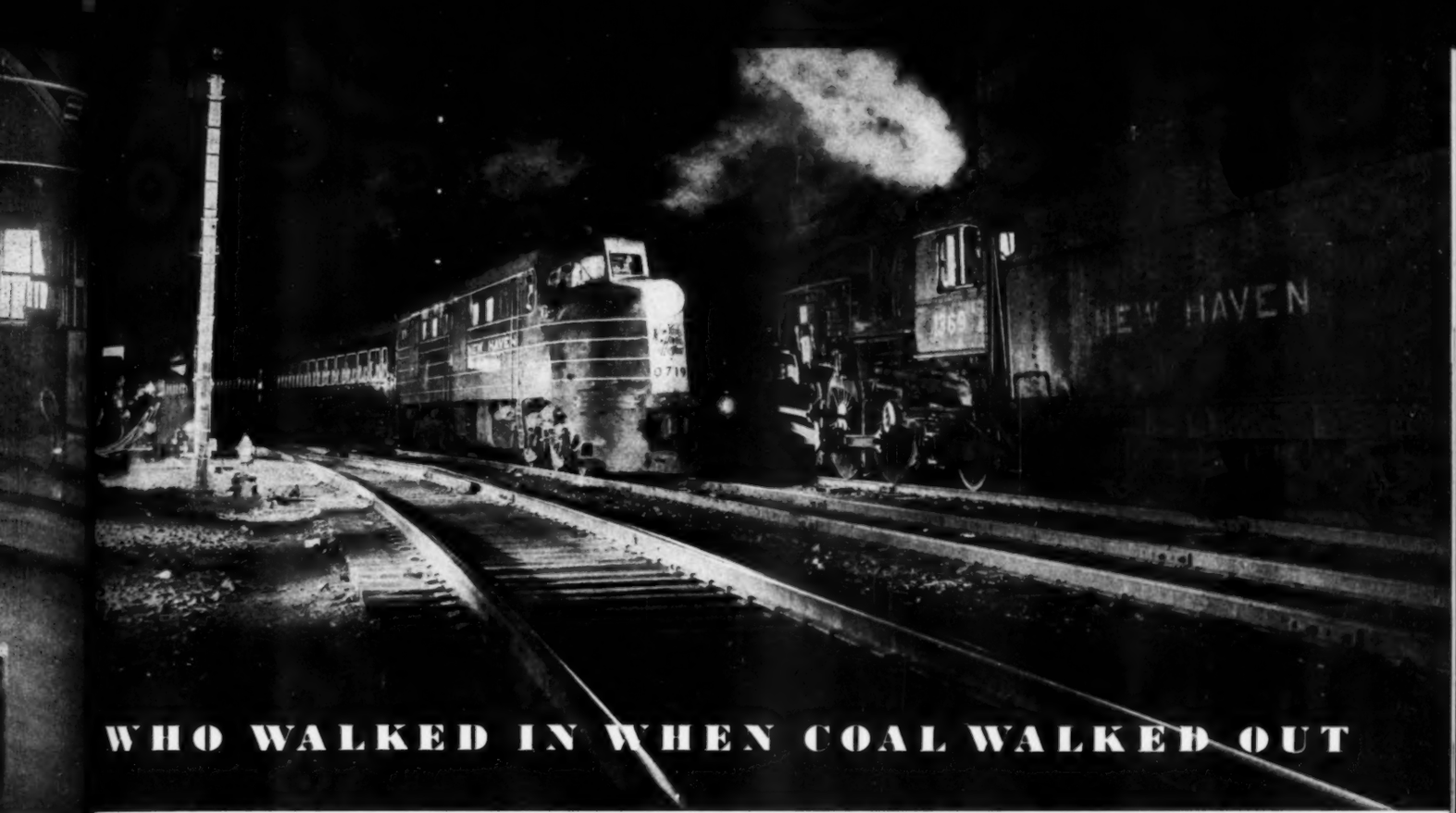
ROADSIDE SPORTLAND DIESELIZED

WILLIAM A. WEART, owner of the Hiohela Sportland situated on Route 30 near Pennington, N. J., caters to quite a variety of the recreational whims of citizens of that region. The Sportland features a handsome eight-lane bowling alley but offers such additional features as a swimming pool, soda fountain, dining room, cocktail bar and a filling station to handle the needs of motorists. Some portion of the enterprise is in operation at all times of the day and night and round-the-clock service has made Sportland a prominent spot in the Pennington area. The bowling alleys attract greatest year-around interest but the swimming pool draws heavy play seasonally. Naturally the bar, fountain and dining room know no "seasonal" restrictions, being active all the year around.

These are the Caterpillar Diesels which have piled up a total of 21,000 operating hours in the last five years, supplying all the electric power for the Sportland.



The attractive Sportland presents a major electric power problem, what with considerable lighting required for all the facilities. Mr. Weart has powered the project since 1941 with two "Caterpillar" Diesel-electric sets which have compiled service records of over 21,000 hours each in providing interior lighting for the bowling alleys, bar, fountain, dining room, filling station and Mr. Weart's own residence. They also provide flood lighting for the swimming pool, the service station and the main building of the establishment. In addition the sets provide power for cooking, both in the Sportland and in the residence and power an ice machine that makes 500 pounds of ice per day. Mr. Weart keeps one set operating 24 hours per day and the other 12 hours per day and alternates the sets so that the burden is carried equally.



WHO WALKED IN WHEN COAL WALKED OUT

THE New Haven Railroad is becoming an old hand at coal-less operation. More and more has the railroad come to depend on Diesels, ready at instant notice to re-assign motive power in the event of another coal crisis. During the month of October 1946, the New Haven's 170 Diesel-electrics comprised only 24.2 per cent of the total motive power available, they accounted for 42.7 per cent of the road's total locomotive mileage. That is in normal operation, not in emergencies.

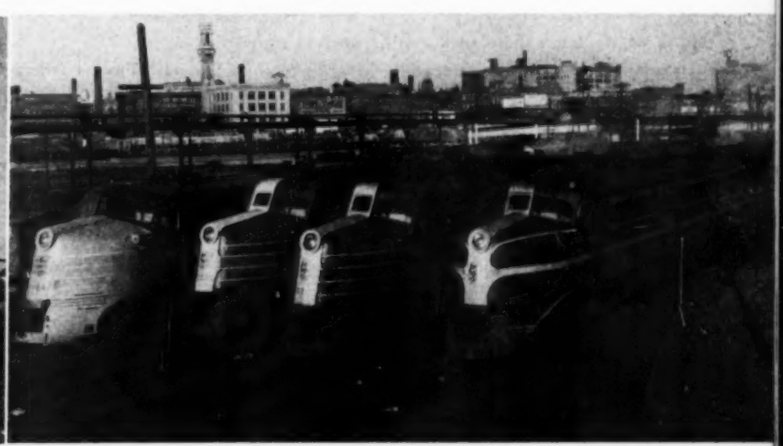
When word was received last November that a 25 per cent reduction in steam mileage was required during the coal crisis, General Superintendent of Transportation, Herbert E. Bixler, advised General Manager Stanley F. Mackay and General Mechanical Superintendent Philip Hatch and all three conferred with Vice President Dean F. Willey to arrange for the reassignment of locomotives. Wherever double-unit Diesel-electric locomotives were in use for the hauling of passenger trains, plans were made to split them apart and make one locomotive do the work of two. Thus the total number of locomotive units available for operating passenger trains was substantially increased. In addition, it was arranged that Diesel-electric units arriving at Boston hauling through trains should be used for round trips of short-haul Boston local service before making the return trip to New Haven with other through trains.

Another fortunate circumstance was the arrival of an experimental 1500 hp. Baldwin-built Diesel-electric of the road switcher type. This was immediately placed in service running passenger trains on the Berkshire line from Danbury to Pittsfield.

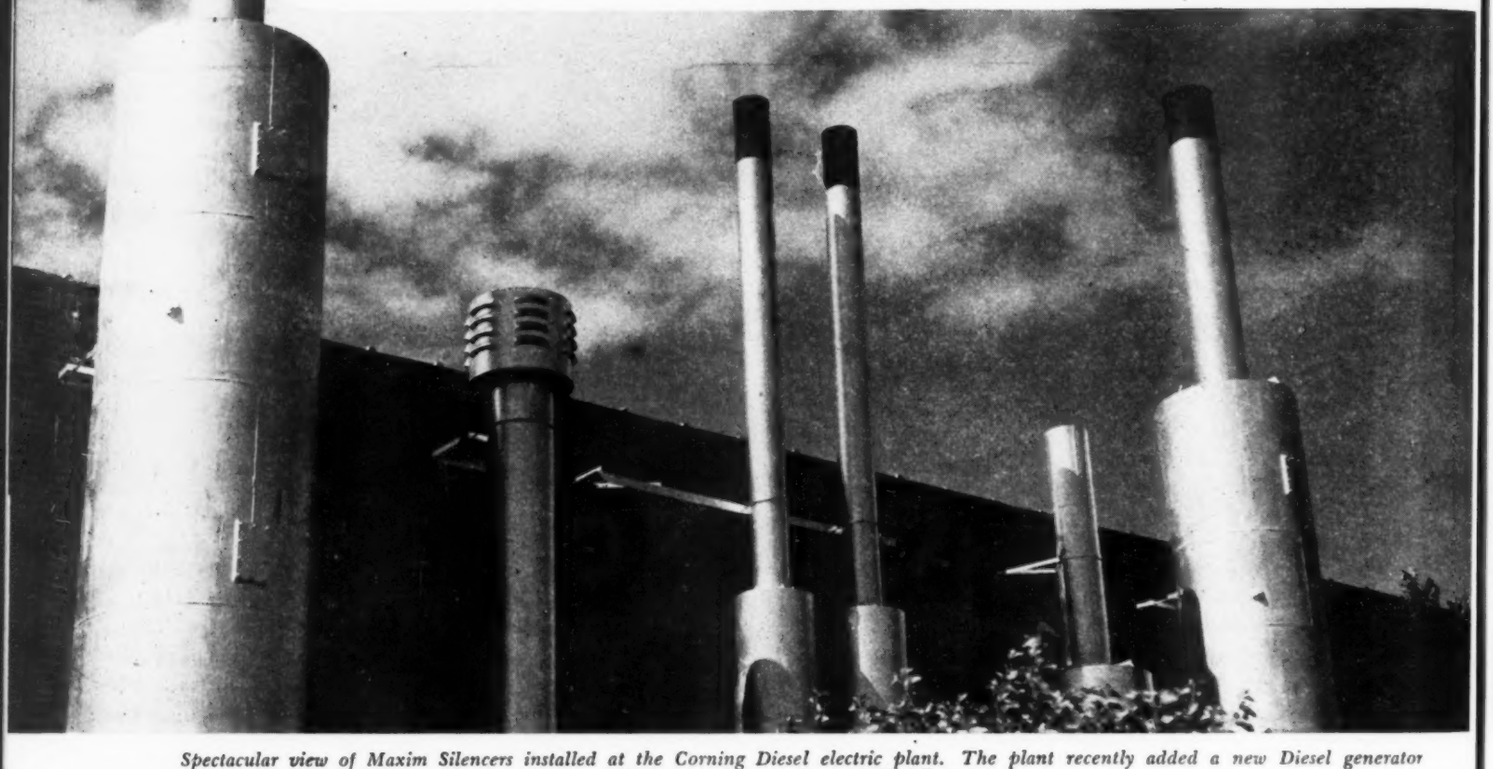
The New Haven recently placed an order for 15 additional Diesel-electric freight locomotives for service on the Maybrook route. Each of these has three 1500 hp. units. This will allow the 2000 hp. units to go into passenger duty on the Shore Line to Boston. In the event of another crisis in coal, the New Haven will be in even better shape for full Diesel operation all along the line.

One Alco Diesel-electric becomes two 2000 hp. locomotives in solving coal shortage.

Part of the New Haven's Diesel-electric fleet standing ready in the Boston yards.



DIESEL PLANT IS GOOD NEIGHBOR



Spectacular view of Maxim Silencers installed at the Corning Diesel electric plant. The plant recently added a new Diesel generator which raises its capacity to 1,447 kilowatts.

By T. J. MALONE

RECENT addition of a 1,000 horsepower engine to the generating equipment of the municipal Diesel electric plant in Corning, Iowa, gives the plant a total horsepower of 2,150 and a rated kilowatt capacity of 1,447, as compared with 1,450 hp. and 943 kw. previously. Last year's peak load was 680 kilowatts. The expension not only provides ample power to serve the increasing demands of consumers but assures a comforting reserve for years to come. It does more than that. It enables the plant to continue and broaden, as it sees fit, its activities in the way of contributed service which mark the plant as a public enterprise, sharing in the life of the community as itself a good citizen and so a good neighbor.

After several years of delaying tactics by a private utility serving the community by transmission line, tactics for which it was made to pay and of which more will be said presently, Corning began operation of its own generating plant late in 1935. It started with three Diesels, of a combined 750 horsepower, supplied by Fairbanks, Morse & Co. It added a fourth two years later, a 700 hp., also Fairbanks-Morse. Corning was growing. Corning now has a population of about 2,200.

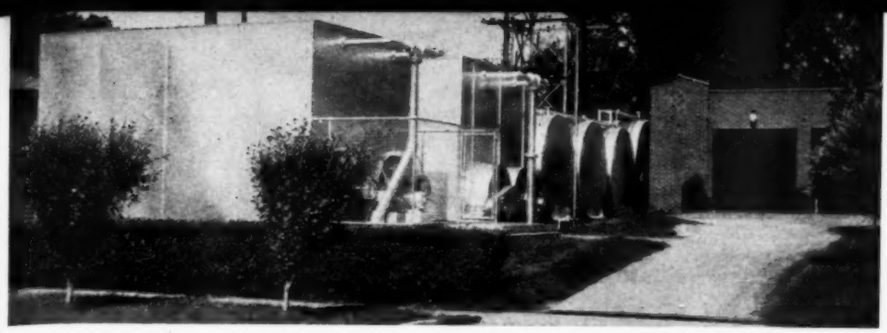
The three engines first installed, two of 225 hp., three cylinders, and one of 300 hp., four cylinders, were crankcase scavenging; the later 700 hp. engine, four cylinders, was pump scavenging. The new Diesel unit, a five-cylinder F-M engine with a 690 kw. rating placed in operation early this year, replaced the 300 hp. engine. Performance of the generating equipment is indicated in the following table for certain key years. The plant operates on a fiscal-year basis, April to March inclusive. The years chosen are the first full fiscal year of operation, the fiscal year next after installing the 700 hp. engine and the latest fiscal year. This is the story:

Year	KWH volume	KWH per gallon of fuel oil	Av. cost per KWH delivered to consumer
1936-1937	1,199,489	11.8	$.0165
1939	1,653,240	12.2	.0114
1945	2,861,590	12.4	.0116

Comparison of total revenue and operating expense of the plant and distribution system for the same years contributes to the picture. Here are the figures.

	Revenue	Operating Expense	Ratio of expense to revenue
1936-1937	$43,426.93	$17,182.08	39%
1938-1939	54,761.55	19,747.15	44
1944-1945	65,881.01	33,160.86	50

The entire cost of the plant, as of March 31, 1945, was $302,632.81, without depreciation. This covered land, building, generating and other equipment, and distribution system. Of a total bond obligation of $280,000, on original plant and additions, $173,000 had been paid from earnings. This in addition to interest and cost of equipment and extensions not cared



View of cooling tower at the Corning plant. It was supplied by the Diesel Service Company. In the background can be seen the Diesel fuel tanks.

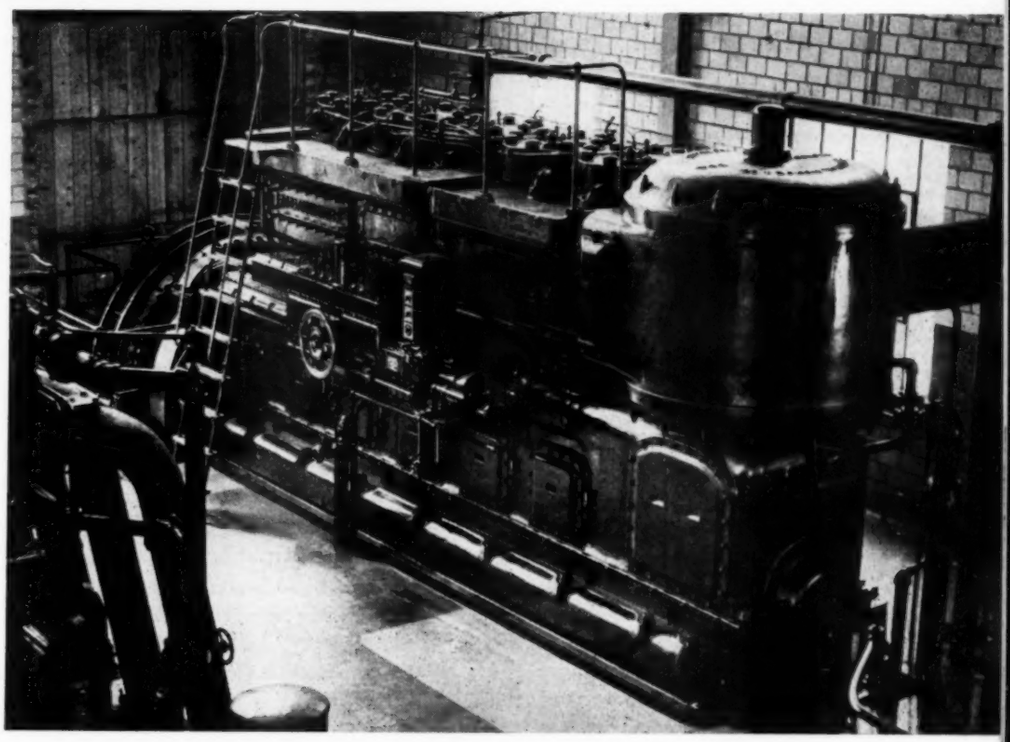
for by bond proceeds. Without purchase of the big engine, the full debt against the plant would have been retired in 1946. With that purchase, the plant authorities expect to be in the clear in 1950. The cash surplus as of March 31 last was $10,234. In addition there was $2,960 in war bonds. A Board of Trustees of three members operates the plant, and the water and sewer systems as well.

Five rate reductions have been made in the life of the plant. Present rates, unchanged since 1940, follow:

Residence—first 50 kilowatt hours per month, 6½c per kwh.; next 50 kwh., 3c; next 50, 2½c; balance, 2c.

Commercial—first 100 kwh., 6½c; next 100, 3c; next 200, 2½c; balance 2c.

Power rates begin at 5c a kilowatt hour for the first 200 kwh. and run through nine levels down to a flat 1c for all excess over 5,000 kwh.



New 1,000 hp. 5 cylinder Fairbanks-Morse Diesel recently installed in the Corning plant.

Exterior of the Corning plant which houses the Diesels whose profitable operation has made possible many civic improvements.

Only the top rates in the first two classifications were changed in the 1940 reduction, each having been 7c instead of 6½c as now. Power rates have not been changed from those prevailing in 1939.

Among industries using considerable power in Corning are a feed mill, two hatcheries and a creamery.

A large rural electric cooperative takes about one-fourth of the plant's output of energy. Current is sold at wholesale at the city limits and the plant has no responsibility from that point. Under the present contract, the maximum load the cooperative may demand is 300 kilowatts at one time.

How costs under the residence rates of the municipal plant compare with those charged by the private utility in its last year is shown in this table:

Kilowatt hours per month	14	25	100	250
Private utility (1935)	$1.62	$2.50	$5.88	$11.50
Municipal (1939)	1.00	1.75	5.00	8.75
Municipal (1940-1945)	.91	1.63	4.75	8.00
Savings per month, 1940-1945, over 1935 rate	.71	.87	1.13	3.50

It is estimated that the municipal plant has saved users of electricity in Corning well over $100,000 since 1935, based on the rates charged at that time by the private utility.

So called "free services" by the plant have been limited largely to special Christmas lighting and the excess cost of street lighting over the amount provided yearly by a small tax levy. In the month of February, 1941, the plant made no billings for service, an experimental concession not repeated during the war. On the other hand, the plant has furthered various community activities by outright contributions from earnings and by service of its personnel.

As a contribution toward the cost of developing a lake reservoir, additional to the city water supply the plant gave $9,500. This $60,000 project includes 200 acres of land and 65 of water, with a drive around the lake, landscaped and set off as a park. "Lake Binder" takes its name from the late Dr. Fred Binder, mayor of Corning when the plant was constructed, a member of its governing board until his death a year ago and an ardent worker for its success. When an improved road was needed to the municipal cemetery, the plant gave $1,200 from its earnings toward building it.

An honor roll board, with names of men and women from Adams County in the armed services of the United States, stands in a park in Corning. It is floodlighted and current is supplied free by the plant.

Then there are the Victory gardens. The plant lends a hand with them too. With about six acres of public land set apart for the war food effort, the plant assigns plots to applicants and even prepares them for planting. Thirty-eight gardens were kept the first year, tweny-five last year; about the latter number were expected for this season.

These things just don't happen. Board members and plant superintendent have a feel for community service. They look about for avenues in which to exercise it. Here is another instance. Business men went in for a purchase of uniform flags for display in front of their places on patriotic holidays. The plant stepped in to house the flags in its building, and to put them up and take them down on the appropriate days. The plant personnel looks after this "free for nothing," as a neighborly act. Additional lighting is furnished without charge for special occasions in schools and churches. Building of a new high school some time ago, with resultant shifting of pupils, left vacant the second floor of a grade school. To the socially minded plant authorities this meant not waste space but opportunity. They, with other forward-looking Corningites, obtained permission from the school board to use the space for a youth center, on their offer to condition, equip and operate it for that purpose.

New flooring was laid, new lighting put in, and a stage, a milk bar, game tables, what not. Now the boys and girls have a place to meet for a good time. Competent supervision is provided. The electric plant supplies lighting equipment and current free.

One can believe that this kind of "Contributed service" wins a return in public appreciation far out in proportion to the money values involved. While making no great drain on the plant earnings, it builds good will.

Every year teachers in the schools are encouraged to bring groups of children to visit the plant, as is done in many other communities having such plants. The children have been learning about government, about pistons and dynamos, about figuring. The class in civics finds that here is government, democracy in action.. Why, this is where we get the power that lights our streets and our homes, that heats our water, that runs our stove, our toaster, our iron, our vacuum cleaner, our fan. And we own it; all of us. In a few years we'll be running this ourselves. The men who direct and operate this plant must be plenty smart.

The arithmetic classes find a challenge in figuring the number of gallons the city water tank, kept filled by the plant, will hold. They figure, too, how many miles a fly on the rim of a Diesel flywheel would travel in an hour, a day, a year, if there were a fly on the flywheel and if it would stay put.

Maybe it comes to some of them that all this activity, all this generation, all this service, goes back to a drop of oil. Sobered initiates into the mysteries of chemistry and physics glimpse that here is the philosopher's stone that transmutes dross into gold.

Members of the Board of Trustees are R. L. Wheeler, F. A. Turner and Fred Bauer. Messrs. Wheeler and Turner have served from the beginning. Mr. Bauer succeeded Dr. Binder. Bruce B. Watts, superintendent of the plant from its start, is also secretary of the board of trustees.

On a wall in the superintendent's office, a framed photostat of a check for $10,231.10 catches the visitor's eye. The check is dated April 25, 1939, drawn payable to the Clerk of District Court of Adams County and bears signatures of two officers of the utility that had tried to block construction of the municipal electric plant. The utility delayed progress by various legal devices in which injunctions and stay orders figured. The city brought suit for damages. It obtained a judgment through a decision of the Supreme Court of Iowa. Of the amount of the check, $9,066.04 went to the city and the rest covered the costs of the case and interest on the judgment.

Corning was plotted in 1855. The man who plotted it named it for a friend, Erastus Corning, a railroad executive of New York. A citizen of Corning, Daniel W. Turner, was governor of Iowa in 1931-1933.

Such public service as shown by the Corning plant is the result of active participation on the part of many public spirited citizens of Corning who could see far enough ahead to realize that their efforts in establishing a municipally owned power plant would be rewarded by the results they see today all around them. Not only have rates been reduced greatly but the town has been vastly improved by the profits of the plant.

2000 HORSEPOWER GAS TURBINE GENERATOR SET*

By THOMAS J. PUTZ**

AN experimental 2000-horsepower gas-turbine generator set that weighs only 19 pounds per horsepower and starts in 1½ minutes or less has been developed for industrial, central station, marine, and locomotive applications. Burning #6 (bunker "C") fuel oil to compensate economically for an expected thermal efficiency of its simple open cycle of twenty per cent at full load, the gas turbine generator set operates at a top temperature of 1350°F.—the maximum practical temperature using currently available materials without resort to cooling. The simplest type of open cycle, consisting of only a compressor, combustor and turbine is employed in order that operating experience on these major components may be most quickly acquired, and the useful output is absorbed by a double-armature d-c traction-type generator connected to the turbine through a single reduction gear. Tests to date indicate smooth mechanical performance.

The possible applications of such a simple open cycle gas turbine are numerous. As a locomotive prime mover it can be built in large powers within a single cab and would require no cooling water. Four of the present units could be installed in a standard cab. For marine auxiliary applications it may find a place as a standby power unit and as power booster, and with regenerators and inter-coolers added to raise thermal efficiency it may serve as the main drive. For large ships, however, the closed cycle may be adopted to reduce weight and space.

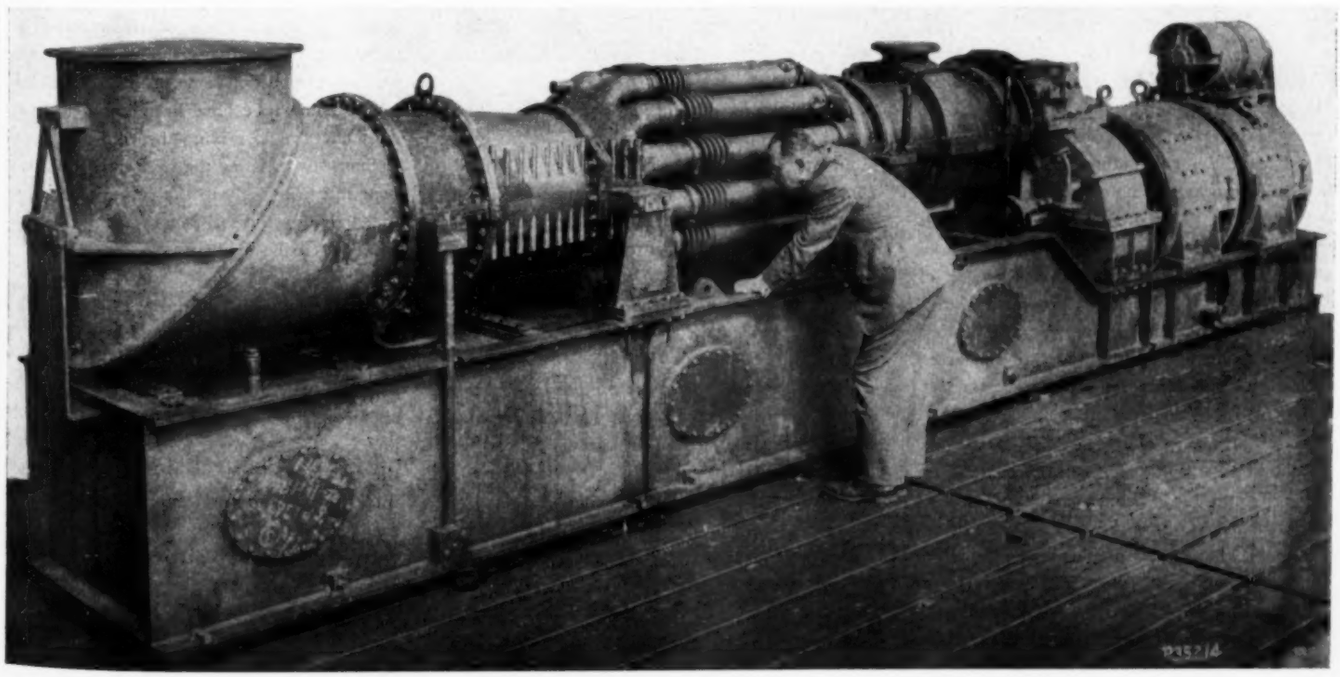
In the central station field the simple open cycle gas turbine lends itself particularly on the ends of transmission lines to use as a standby unit for peak service. The expense of banked boilers and spinning reserves required of central station steam plants could be reduced by the substitution of low cost, quick starting gas turbines which could be strategically located to cover system peak loads. Other applications such as portable power plants in the gas fields, power units for gas transmission lines, and power plants for factories where circumstances make it advantageous are all attractive possibilities.

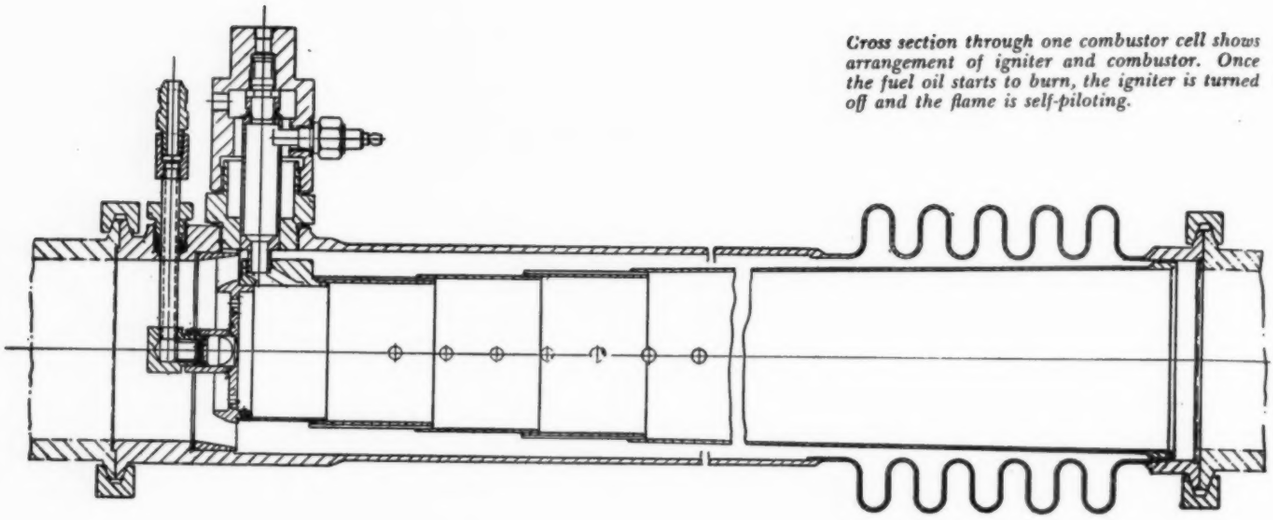
In operation, air is taken in by the compressor through the inlet metering nozzle and silencer

* *This paper was presented before the Annual Meeting of the American Society of Mechanical Engineers, New York, December 5, 1946.*

** *Manager, Gas & Locomotive Turbine Section, Steam Division, Westinghouse Electric Corporation, South Philadelphia, Pennsylvania*

2000 hp. gas turbine generator set. From left to right, are the exhaust diffuser, gas turbine, combustors, compressor, reduction gear and generator.





Cross section through one combustor cell shows arrangement of igniter and combustor. Once the fuel oil starts to burn, the igniter is turned off and the flame is self-piloting.

and compressed to pressures of 30 to 75 psi. absolute, depending on the load carried. Fuel oil is mixed with the compressed air and burned in the combustors, the amount of fuel burned being controlled to limit the temperature of the gases to between 700°F. and 1350°F. at the combustion chamber outlets. The hot gases are expanded through the power-producing turbine and the resultant exhaust gases pass through a diffuser, elbow, and silencer to the atmosphere. The turbine develops approximately 6000 horsepower, of which 4000 horsepower is used to drive the compressor. The remaining 2000 horsepower is the useful output delivered to the d-c generator. The full load speed of the turbine and compressor is 9200 rpm. while the generator speed is 1200 rpm.

The complete assembly measures 26 feet long, 3½ feet wide and 6 feet high. Components are arranged in order from one end to the other of exhaust diffuser and elbow, gas turbine, combustors, compressor, single reduction gear, and d-c generator. The straight line arrangement saves piping, space and weight and keeps pressure drop to a minimum. The total weight of 38,000 pounds is divided approximately one-third to the turbine, compressor, combustors, and gear; one-third to the bedplate and accessories; and one-third to the d-c generator.

The compressor is of the axial flow type, designed to pass 25,000 cfm. of air at a pressure ratio of 5 to 1. It has a maximum speed of 9200 rpm. and the pressure ratio is varied from 2:1 to 5:1, depending on the load carried, by changing the speed. It contains twenty stages of non-symmetric blading designed so that the major pressure rise occurs in the rotating blades. The latter have a constant tip diameter of 18⅜ inches and vary in height from 3 inches at the inlet to 1½ inches at the discharge. The blades, unshrouded and profiled at the tip, are forged from twelve per cent chromium steel stock similar to that used in steam turbine work. The serrated root fastening is machined in the base by using a formed milling cutter. The blades are caulked into serrated grooves cut in the rotor. Stationary blades are precision cast of 18-8 stainless steel and are caulked into grooves cut in the cylinder wall. They too are unshrouded and profiled at the tip.

The rotor is made of a solid carbon steel forging and the cylinder of welded steel plate. All air seals on both ends of the compressor are of the labyrinth type. The compressor, being solidly connected to the turbine, has the greater part of its thrust balanced by the turbine thrust thus eliminating the need of a dummy. The small remaining thrust unbalance is taken by a standard segmental shoe type bearing, located on the discharge end of the compressor. The journal bearings are of the pressure lubricated sleeve type. For test purposes, a bleed connection has been provided after the eighth stag, but it has proved unnecessary and will not be provided on future units.

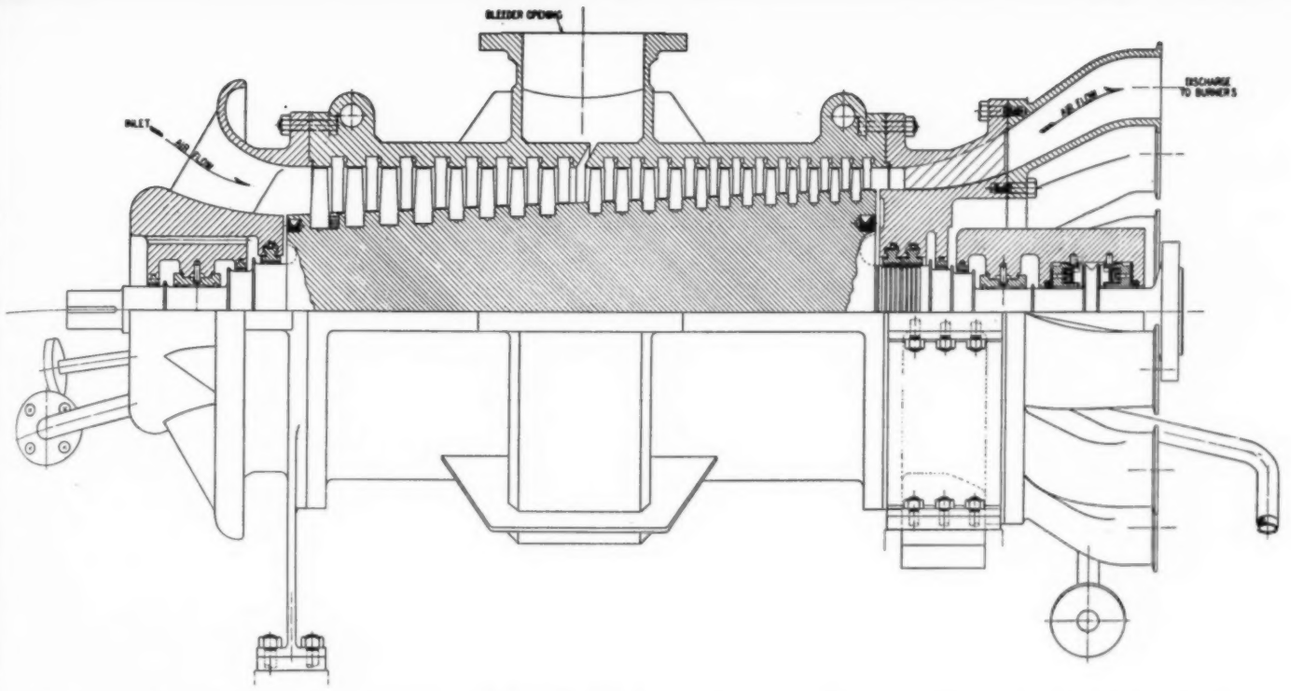
The air flow passes from the compressor through a diffuser where the velocity is reduced and transition is made from an annular passage to twelve circular passages. The diffuser is made of castings welded together.

The twelve cell type combustors, 4½ inches in diameter and 3 feet long, have heat releases of approximately 1.2 by 10^6 Btu/hour/cu.ft./atmosphere. Their casings are made of carbon steel pipe with a bellows type expansion joint welded to on end and tapered flanges welded to both ends. The flame tube is made of chromium-nickel alloy sheet rolled into circular sections which are spot-welded together. Alternate sections are corrugated to provide side-wall cooling.

The #6 (bunker "C") fuel oil is injected through air atomizing spray nozzles, held in the end plate of the flame tube. These nozzles maintain good atomization at low fuel flows. After the oil is ignited the flame is self-piloting, i.e., there is a primary combustion zone within the flame tube to which only a part of the air is admitted and in which a flow reversal is created. In the rest of the combustor the secondary or dilutant air which surrounds the flame tube is mixed with the hot gases from the primary combustion zone. Axial rows of holes in the flame tube have been found to be the most effective in mixing the cold and hot air streams. In this way the cold gases are able to penetrate effectively to the center of the flame tube, giving very satisfactory temperature distribution at the discharge.

Ignition of the #6 (bunker "C") fuel oil is accomplished with acetylene igniters. They are constructed with an outer casing that screws into the combustor casing. Within this outer casing a flame tube, containing a "Monarch" nozzle with the core removed, extends through the combustor casing and the main flame tube into the primary combustion zone. Acetylene gas is piped to the "Monarch" nozzle at a difference of 2 psi. above the compressor discharge pressure, and a spark plug is used to ignite it.

An igniter has also been developed to use No. 3 furnace oil instead of acetylene gas. Twelve



Cross sectional drawing of the 20-stage compressor. The rotor is positioned by a segmental thrust bearing located at the discharge end.

combustors were used to expedite full scale component testing with available facilities.

The gas turbine itself consists of eight stages designed for equal heat drop over the stationary and rotating blades at the mean diameter. The shaft seals used are all of the labyrinth type, and the journal bearings are of the pressure lubricated sleeve type. Blading is made of cobalt-chromium-tungsten alloy by the precision casting method. The rotating blade is tapered and twisted and has a serrated root machine in the base. This machining is accomplished with a form type grinder which in turn is dressed with a crusher wheel. The stationary blades are also tapered and twisted and have a single "T" type fastening which is machined by using a carbide tool. All of the blading is unshrouded and profiled at the tip.

The rotor is machined from a solid forging of stabilized 19-9 stainless steel, the main section being 14½ inches in diameter and 24 inches

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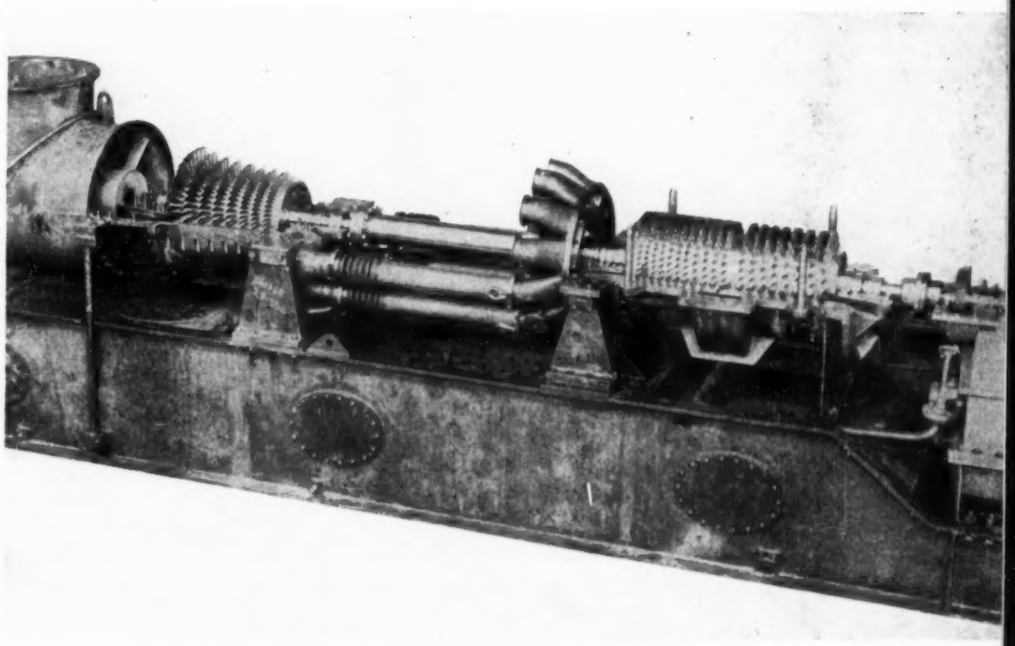
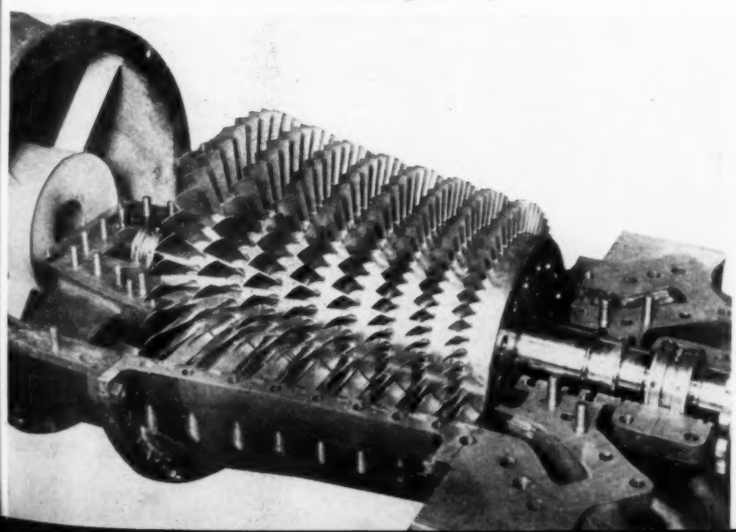
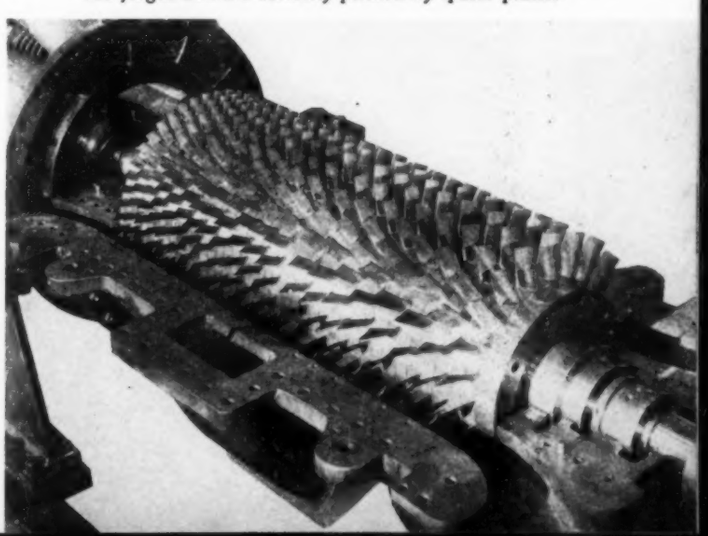


Gas turbine generator set with covers removed. Gas turbine is at left, compressor at right, with combustion and ignition chambers, center.

Closeup of turbine blading which consists of eight stages. Blades are cobalt-chromium-tungsten alloy.



Compressor rotor shown mounted in the cylinder base. Rotating blades are forged and are correctly pitched by spacer plates.



DIESEL PROGRESS IN GREAT BRITAIN
PART II

By HAMISH FERGUSON

Diesels in the Fishing Industry

PRIOR to 1939 edible fish, always an essential of normal diet, could be procured by Great Britain largely in her own home waters. Some of the higher grades, such as salmon and sardines, were imported but fresh fish was available in sufficient quantities near her own shores.

With the advent of war, supplies from Scandinavia and Portugal ceased and those from Canada and other countries were greatly restricted. In addition, nearly all Britain's younger fishermen joined the Royal Navy or Merchant Navy, leaving only the older men to carry on with such vessels as were not taken over for conversion to mine-sweepers. Imports of frozen cod from Newfoundland and Iceland, supplemented by canned fish from the U.S.A. under the Lease-Lend Agreement, made it possible for a small supply to continue to reach the average home.

The situation has now changed and Britain's fishing fleets are being rehabilitated and expanded. It is significant that, with hardly an exception, all the trawlers and drifters now building are Diesel-propelled and there are more vessels under construction now than ever before in the history of the industry.

Providing reliability is assured, operating cost will always be the first consideration when deciding on the type of engine to be selected for any particular duty. In the case of the modern long-distance trawler, having a speed of around 10 knots, it has been estimated that one ton of oil per day will suffice where 5 tons of coal would be required in a steam trawler carrying out the same duties. Thus the saving on fuel cost alone is very considerable. Again, oil is much more easily handled and requires less space so that bunkering is facilitated, permitting the ship to be turned round more quickly and more fish room can be made available. The number of hands can also be reduced by dispensing with stokers and these factors together can lead to increased profits both for the owners and the crew.

Both 2-cycle and 4-cycle engines are in use in modern trawlers but the 4-cycle is by far the more popular. Cylinder sizes are normally limited to 17 in. though the majority are rather smaller, being around 12 to 14 in. Engine speeds are usually between 400 and 500 rpm. though higher speeds are sometimes adopted where an electric drive is used. Direct reversing engines are now seldom employed, preference being given to the reverse reduction gear, either mechanically or hydraulically operated.

The crankcase-compression engine is now obsolete and a scavenge-pump or blower is invariably included in the design of 2-cycle engines. There is an increasing tendency to adopt pressure charging for the 4-cycle engines and it appears that this will become standard practice. There is evidence that Diesel-electric propulsion is increasing in popularity.

After selection of the main engine, the next most important item is the method of operating the trawl winch. This can be done in a variety of ways:—

(a) By pulley drive from the main engine shaft using a jockey pulley to apply the load.
(b) By electric power derived from a generator operated by the main engine through a clutch.
(c) By direct drive from an auxiliary Diesel.
(d) By electric power derived from an auxiliary Diesel generator which also supplies power for lighting, heating, pumps, etc.

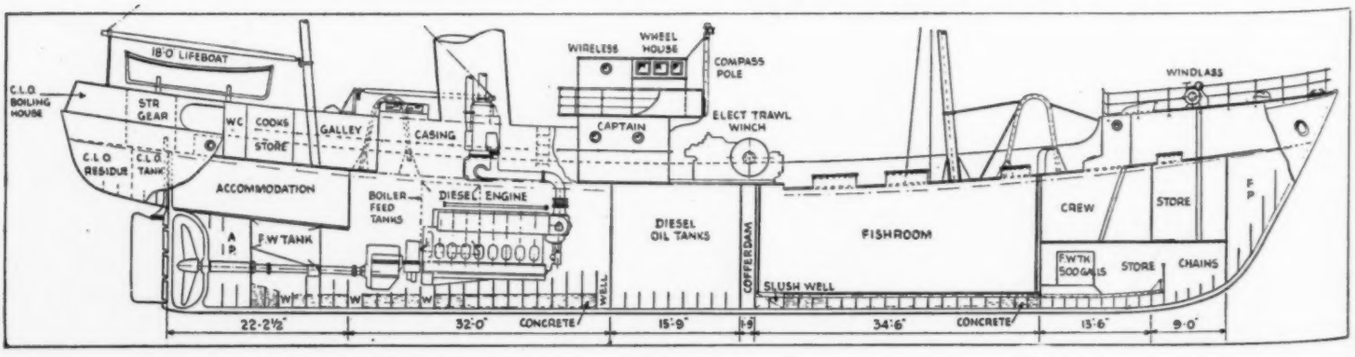
The last mentioned method is increasing in favour among efficiency-minded fishermen.

The engines selected are nearly always of the 4-cycle vertical type. Sometimes a special auxiliary is installed for operating the trawl winch while a smaller unit takes care of the other services but, again, the use of electric drive throughout appears to be the modern trend.

A steam supply is always an essential in fishing vessels for process work, de-icing, etc. and it is the modern practice to produce the required amount by utilizing the waste heat in the engine exhaust gases in suitable boilers which can be supplemented by oil-firing as necessary.

In addition to waste-heat boilers it is usual to extract the waste-heat in the engine cooling water by arranging the cooling system in a closed circuit. This permits distilled water to be used through the engine itself; the distilled water is cooled in a heat-exchanger using sea-

Centerline profile view of "Milford Marquis," 156 ft. overall, beam 24 ft. 6 in. powered by a 750 bhp. Ruston Diesel.



water as the secondary coolant. In some cases the heated sea-water is passed through a calorifier to preheat the water entering the steam-raising boilers.

Centrifuges or filters are normally fitted for cleaning both fuel and lubricating oils. Air intake and exhaust silencers are provided to add to the comfort of the crew.

Typical of the modern trawlers is the *Milford Marquis* built by Cochrane & Sons Ltd. She served during the war as a mine-sweeper in the Mediterranean and Indian Ocean. Her maiden voyage as a trawler was made in July, 1946 after her reconversion.

The *Milford Marquis* has the following dimensions:—

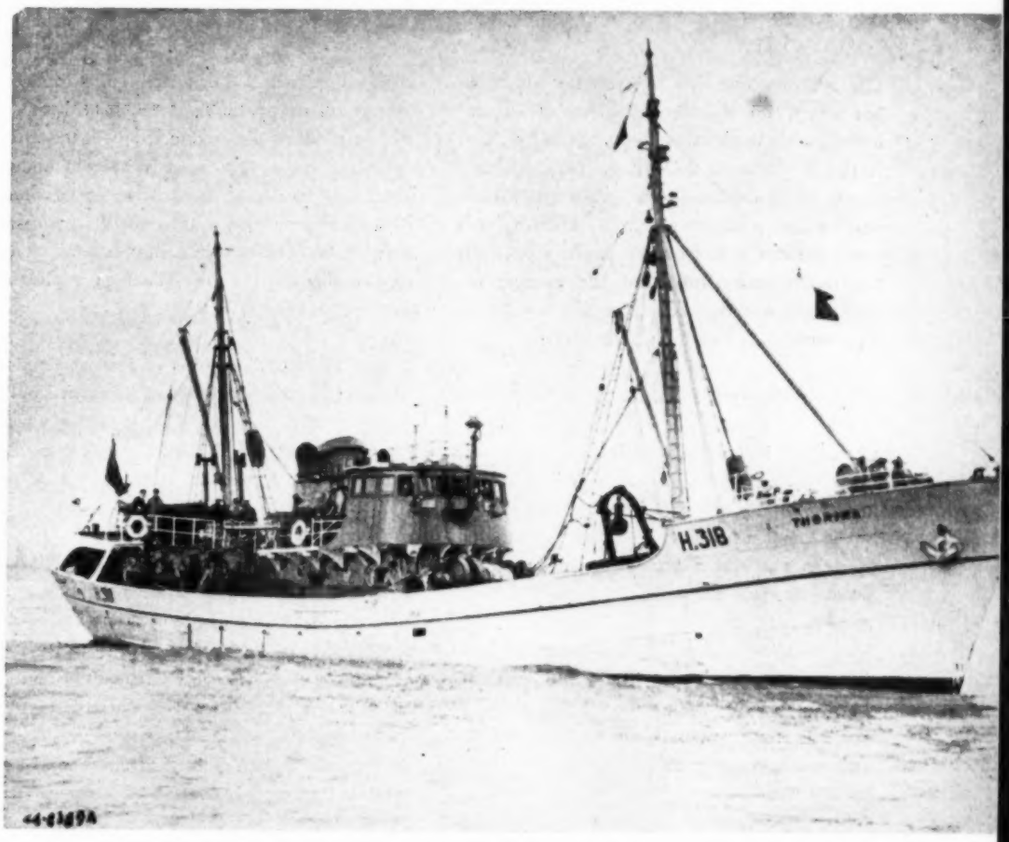
Length overall	156 ft. 0 in.
Length between perpendiculars	140 ft. 0 in.
Beam	24 ft. 6 in.
Draught aft	15 ft. 0 in.

The vessel is propelled by an eight-cylinder 4-cycle Ruston Diesel engine pressure-charged on the Buchi system and developing 750 bhp. at 400 rpm. The drive is taken to a 9 ft. 6 in. dia. propeller through a 3 to 1 oil-operated reverse-reduction gear. To provide a supply of electric power when at sea, the main engine drives a variable speed generator with voltage regulator. This avoids the necessity of running the auxiliary Diesel generators when the main engine is in operation.

The trawl winch is electrically operated and has two barrels each accommodating 1,000 fathoms of warp. The steering gear is electro-hydraulic. The fish hold capacity is 7,530 cu. ft. and a motor-driven refrigerating plant is provided for cooling the fish room.

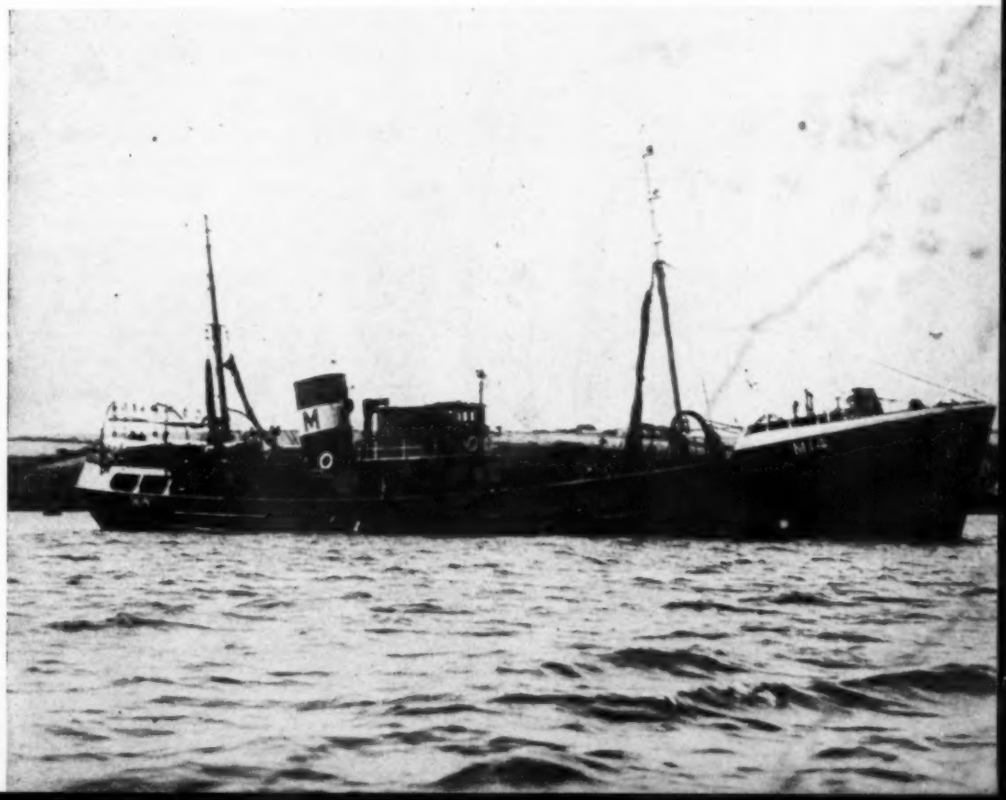
Power for the trawl winch is supplied from a six-cylinder 4-cycle Ruston Diesel direct coupled to an 80 kw. d.c. generator fitted exclusively for this purpose. The air compressor and pumps are clutch-operated from a further 3-cylinder Ruston engine which also drives a generator to provide lighting when the main engine is not in operation. Steam is provided by a complete thimble-tube boiler which utilizes the main engine exhaust gases and can be supplemented by oil firing. The vessel's service speed is 12½ knots and with a bunker capacity of 103 tons she has a range of 8,000 miles.

The employment of Diesels in trawlers did not get a real start until the early 1930's and many of the early vessels equipped were conversions from steam. It was not to be expected that these would be wholly satisfactory but now that the modern trawler is properly designed for Diesel propulsion it seems likely that it will entirely supersede steam in the long run.



"Thorina" built for arctic service—length bp. 133 ft. beam 25 ft. 6 in.—engined with 585 bhp. Ruston and Hornsby Diesel.

Built by Cochrane and Sons Ltd. the "Milford Marquis" seen below served as a mine-sweeper before her trawling career. She is propelled by a Buchi pressure-charged Ruston Diesel.



HORSEPOWER FROM THE INDICATOR*

By DR. P. H. SCHWEITZER, The Pennsylvania State College

SINCE its invention by Watt the indicator has served for the determination of engine horsepower. What the indicator actually gives is the pressures on the piston. However, the piston being ordinarily the only engine component that produces power, by knowing the mean pressure acting on the piston as well as the piston area stroke and the number of strokes per minute, the power developed can be determined. The familiar formula is

$$IHP = \frac{PLAN}{33{,}000}$$

where *IHP* is the indicated horsepower, *P* the mean indicated pressure in psi, *L* the stroke in feet, *A* the piston area in square inches and *N* the number of power strokes per minute (rpm. in two-stroke cycle engines, rpm./2 in four-stroke cycle engines).

Load and horsepower. Before discussing how the mean pressure *P* can be determined from various types of indicator cards, it seems desirable to discuss generally the relation between load and horsepower on which many operators have unclear ideas. Not a few operators in the marine as well as the stationary field have the notion that load and horsepower are more or less synonymous. They take it for granted that increasing the load means increasing the horsepower and vice versa. If a 1000 hp. engine develops 500 hp., it is quite common to speak of it as running at half load, irrespective of whether the engine speed is the same or not. Some operators are unable to understand how an engine can be overloaded when it is developing only a fraction of its normal horsepower. They fail to realize that in certain applications the load may be high while the engine speed is low.

It may be helpful to think of load as a resisting force to engine rotation, designated by the technical term "torque." That is easy to visualize if we imagine the load applied to the engine in the form of a braking force *W* on the periphery on a 1 ft. radius flywheel. Load or torque is then equal to *W* ft.-lb. If the shaft center is as shown in Fig. 1 the torque is $T = Wa$. When the torque *T* is known (as determined for instance by a Prony brake) the horsepower can be calculated by the formula

$$BHP = \frac{2\pi T \times rpm.}{33{,}000}$$

If we simply consider load as another expression for torque confusion can be safely avoided. It at once becomes clear that if the torque is increased while reducing the speed, the engine may be overloaded while its horsepower output (which varies with the product, torque × rpm.) diminishes. In fact by increasing the load high enough the engine will stall which means that its power output will drop to zero. On the other hand, it may happen that the power output goes up. Such conditions are common with road vehicles, tractors, excavators, etc.

There are, however, two categories of engine applications where these relations are obscured by the nature of the application. One case is when the engine drives a constant speed electric generator. The engine speed being held constant or almost constant by a sensitive governor, load and power vary in direct proportion. In that case it is harmless to identify load with power. Half load does mean half power and quarter load quarter power in a constant speed engine.

The other case is the directly (or gear) driven marine propeller. The nature of the propeller resistance is such that it increases approximately as the square of the rotative speed. The power absorbed will in consequence go up as the third power of the speed. With a propeller submerged in water, load and power will, therefore, always rise and fall together, but half load does not correspond half horsepower even if the two are frequently linked for lack of precision.

The important thing to the operating engineer is that most of his observations are linked to the engine load rather than to the engine power. The rack seting of the injection pump varies with the load and not with the power. The exhaust temperature and smoke are more an index of the load than of the power. Finally the indicator diagram is an image of the engine load and not of the engine power.

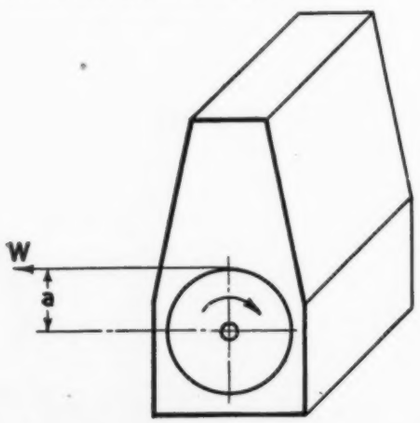


FIG. 1 LOAD, TORQUE, & HORSEPOWER

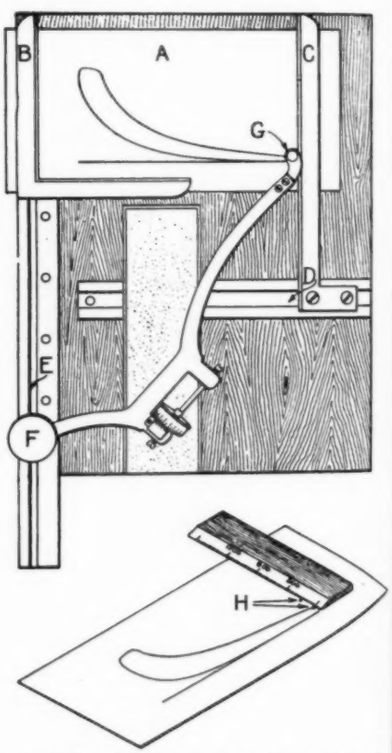


Fig. 2. Coffin planimeter for determination of the mean height of indicator diagram.

Indicated and Brake Horsepower

In the first horsepower formula, the indicated horsepower *IHP* was related to the mean pressure *P*, in the second the brake horsepower *BHP* was related to the torque. The indicated horsepower is always greater than the brake

* *This is a continuation of the series of articles, "Trouble Shooting with an Indicator" published in DIESEL PROGRESS, October, November and December 1946.*

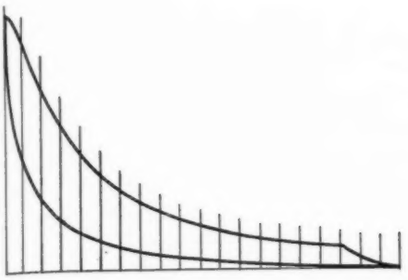


FIG. 3 HORSEPOWER FROM INDICATOR. TWO STROKE CYCLE ENGINE. 28 INCH BORE, 44 INCH STROKE 120 rpm

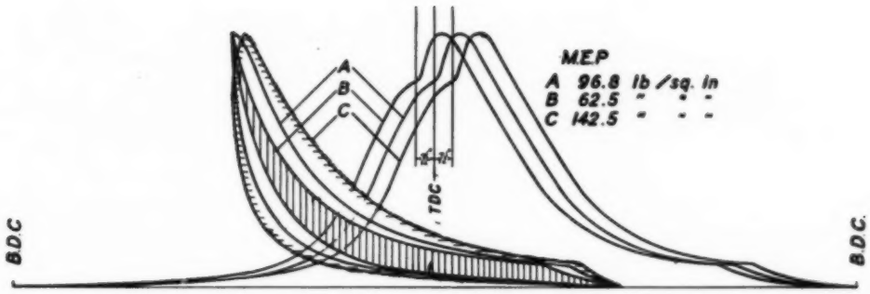


FIG. 4 EXHAUST & INTAKE PISTON PRESSURE STROKE DIAGRAM OF OPPOSED PISTON ENGINE. (EXHAUST PISTON 15° AHEAD OF INTAKE PISTON)

horsepower by the friction horsepower which is absorbed by the rubbing parts of the engine and does not appear as useful power on the shaft. The mechanical efficiency expresses the ratio between the brake and indicated horsepower

$$ME = \frac{BHP}{IHP}$$

and in well constructed Diesel engines the mechanical efficiency is about 80 per cent at full load, except in the high speed engines where it is about 70 per cent.

The familiar horsepower formula will give the brake horsepower directly if instead of the mean indicated pressure (*mip*), the brake mean effective pressure (*bmep*) is set for *P*, which makes the formula read

$$BHP = \frac{(bmep)\ (LA)\ N}{33{,}000}$$

or substituting for (*LA*) 1/12 times cylinder displacement in cu. in.

$$BHP = \frac{(bmep)\ (Displ/12)\ N}{33{,}000}$$

which compared to the *BHP* torque formula gives

$$bmep = \frac{2\ T\ (rpm)\ \pi}{(Disp\ 1/12)\ N}.$$

Considering that *N* is either equal to rpm. or one-half of it, we obtain the following simple relations:

$$\text{In a 4-stroke cycle engine bmep} = \frac{48\ \pi\ T}{Displ}$$

$$\text{In a 2-stroke cycle engine bmep} = \frac{24\ \pi\ T}{Displ}$$

T is to be expressed in ft.-lb., Displ in cu. in. π is 3.14 and *bmep* is obtained in lb. per sq. in.

More important than the numerical relations is the fact that torque and brake mean effective pressure vary in direct proportion in any given engine. Since torque is the true measure of the load, engineers have come to express the load in terms of bmep. That is perfectly justified as well as convenient. If the rated bmep. of a Diesel engine is 80 psi., half load is equivalent to 40 psi. bmep. and quarter load 20 psi. bmep., irrespective of the horsepower output of the engine. This is an important point that many operating engineers are prone to overlook.

Mean Pressure from the Indicator

The indicator diagram, as it was explained above does not give the bmep. but the mip. which must be multiplied by the mechanical efficiency in order to obtain the bmep. and from that the brake horsepower. In many cases, however, the indicated horsepower is sought, which can be determined directly.

The mean indicated pressure is nothing but the average pressure acting upon the piston, that means the average height of the in-phase indicator diagram. In order to determine the mip. from the indicator card the area of the diagram must be measured. For measuring areas of irregular shape, such as an indicator card, an instrument known as the planimeter is widely used.

Most any planimeter may be used for the determination of the mip. from an in-phase indicator card, by determining the diagram area in whatever units the planimeter reads and dividing that area by the base of the diagram measured in the same units. The Coffin planimeter shown in Fig. 2, which gives the mean height of the diagram directly is frequently used in the Navy. If no planimeter is available the mean height of the diagram may be determined by dividing the diagram in, say, 20 segments, adding up the heights of the 21 individual ordinates and dividing the sum by 21.

Example: A 6-cylinder two-stroke cycle engine with 28 inch bore, 44 inch stroke running full load at 120 rpm. gave the indicator card shown in Fig. 3.

What is the indicated horsepower of the engine?

By planimetration the area of the diagram is determined as 0.872 sq. in. The base of the diagram is 2.77 in. The mean height is, therefore, 0.315 in. Since the spring scale is 300 psi. to an inch, the mean indicated pressure is 94.5 psi.

If no planimeter is available, the height of the 21 ordinates of the 20 segments are added up and divided by 21.

$$\frac{.00 + .03 + .08 + .15 + .15 + .15 + .16 + .18 + .19 + .21 + .24 + .27 + .31 + .36 + .40 + .47 + .56 + .67 + .78 + .80 + .33}{21} =$$

.309 in. which gives approximately the same result.

Having the mip., the indicated horsepower is calculated.

$$IHP = \frac{94.5 + \frac{28^2\pi}{4} + \frac{44}{2} + 120}{33{,}000} = 776$$

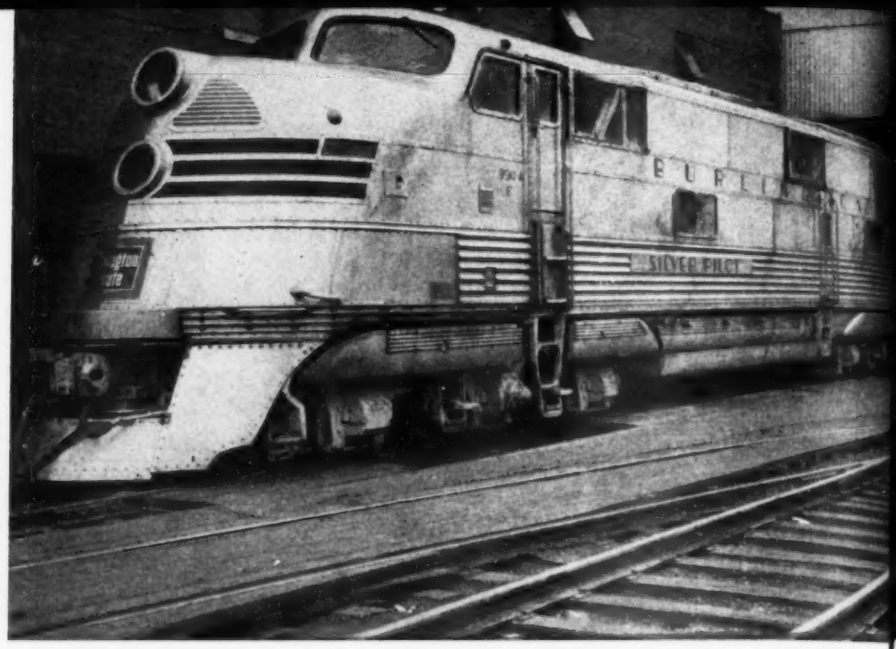
for one cylinder and $6 \times 776 = 4656$ hp. for the six cylinder engine. For calculating the brake or shaft horsepower the mechanical efficiency must be known. If that is known to be 80 per cent, then

$BHP = 0.8 \times 4656 = 3725$ horsepower.

Horsepower from Pressure-Time Diagrams

The determination of the indicated horsepower is one instance where the in-phase p-v diagram is preferable. Power is the rate of doing work. Work is force multiplied by the distance through which the body is moved as a result of the force, that means piston travel. In the p-v diagrams the abscissa corresponds to the piston travel, therefore, the area of the diagram

. . . . *And now please turn to page 71* . . . .



Burlington's "Silver Pilot," a crack Diesel streamliner, is equipped with complete fire protection

FIRE PROTECTION FOR DIESEL LOCOMOTIVES

By DOUGLAS SHEARING

WITH the rapid development of Diesel in the railroad field, there has been a similar development in the accessory field keeping abreast of latest designs in railroad equipment. Safety features have not been overlooked. Train safety has been augmented in some special instances by the installation of radio-telephone communication between trains and dispatching points.

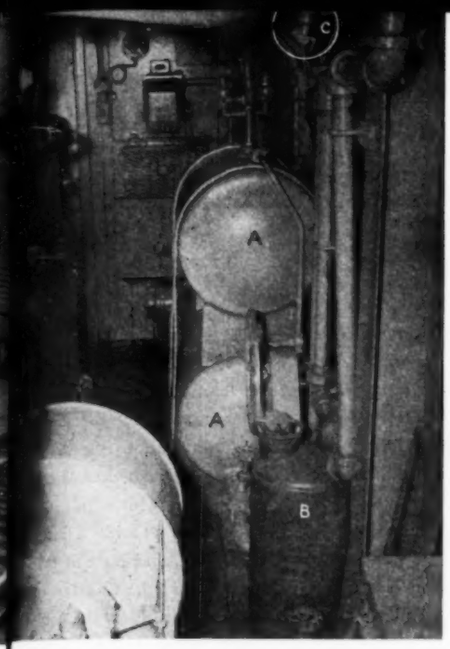
However there is an increasing need for adequate fire protection equipment aboard these sleek Diesel streamliners. Noted as they are for their inherent advantages over other types of locomotives in this regard, nevertheless, they are subject to fire hazards. Electrical equipment may become overheated, oil lines may part, brake shoes may send sparks to combustible material; these and many other factors may cause great damage by fire. A survey conducted by the Fire Protection and Insurance Section of the Association of American Railroads in 1945 pointed out the causes of major fires on Diesel locomotives. These causes together with their frequency are listed in Table I.

Several of these fires resulted in major losses and are probably well known to most railroad officials, but there are probably many other instances of minor fires that were of no consequence. All estimates of damage are based on damage to the locomotive and nothing else. No estimates are available concerning the damage to the freight and passenger equipment involved, nor fire damage to right-of-way. Most important, there are no figures available on the loss of revenue due to an out-of-service locomotive.

The need for fire protection equipment has been recognized by several railroads throughout the country. The Seaboard, Pennsylvania, Great Northern, Burlington and others have installed fire protection equipment on their existing Diesel locomotives. As equipment be-

Battery of five 50 lb. carbon dioxide cylinders carried by the "Silver Pilot."

Outside view of locomotive showing hose and connection for foam and water (A) and remote manual pull-box for releasing carbon dioxide gas within the locomotive (B).



Inside locomotives: (A) two 60 gallon tanks for foam and water system; (B) foam proportioning tank which will produce 3500 gallons of foam; (C) one of C-O-Two baffle nozzles for filling space with carbon dioxide gas.

comes older, there is a tendency for more fires to occur and it seems probable that sooner or later all operators will install adequate fire protection equipment. There are several recognized danger spots on Diesel locomotives. There are the fires caused by the engine and auxiliary equipment. Blown gaskets, leaking oil lines, hot compressor lines, broken V-belts, and a host of other small causes. Then there are the fires caused by electrical failures in controls, relays, circuit breakers, etc. Battery box fires can be included under this heading. Fuel oil fires caused by leaking oil lines may vary from small fires to ones of devastating effect when fuel tanks are punctured. A cause which leads the list for locomotive fires is the sparking of brake shoes which ignites the oil-saturated road debris under the body of the locomotive.

To combat these fires, automatic smoke detecting equipment and fire alarm systems are available to warn the engineer. Foam, water, and carbon dioxide-charged equipment, both portable and built-in, are provided for fire fighting. Some such equipment can be utilized for fighting fires on equipment other than the locomotive itself, thus making the locomotive a tracked fire engine available for extinguishing fires aboard other rolling stock.

Experts in fire protection equipment believe that no single extinguishing agent is a cure-all, but some railroad men prefer to use carbon dioxide alone. This may be because of their concern over teaching a train crew how to use more than one piece of equipment, although similar training is successful in general industry. In any case, it seems imperative that smoke detecting and fire detecting equipment, with audible and visual alarm means, be provided to give early warning of fire. Unless a fire is discovered promptly, it may gain too much headway to be extinguished.

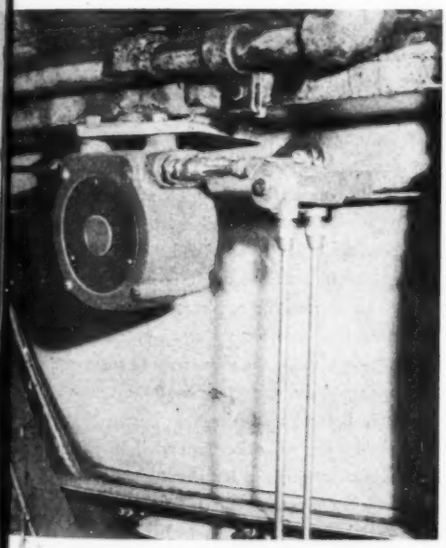
It has been suggested that locomotive builders incorporate plans for a fire protection system in new locomotives. The reasons for such a suggestion are very plausible if, sooner or later, fire protection equipment will be installed by the operator. Fire protection engineers, if consulted during the planning stage of locomotive building, are able to suggest ways to reduce fire hazards. They may advise better locations for tanks, oil lines and electrical equipment or suggest the separation of hazards that are unavoidable, a practice that has been followed in many industries.

Secondly, for economy reasons, it is better to install protection equipment when the locomotive is being built. The original cost of the equipment is lower when ordered in multiple quantities. The installation costs are less since the equipment can be fitted without alteration to the locomotive. Lastly the efficiency of the equipment is greater if it is built as an integral part of the locomotive with warning devices placed to best advantage, extinguisher cylinders in places of easy access, and hose and spray equipment available for instant use.

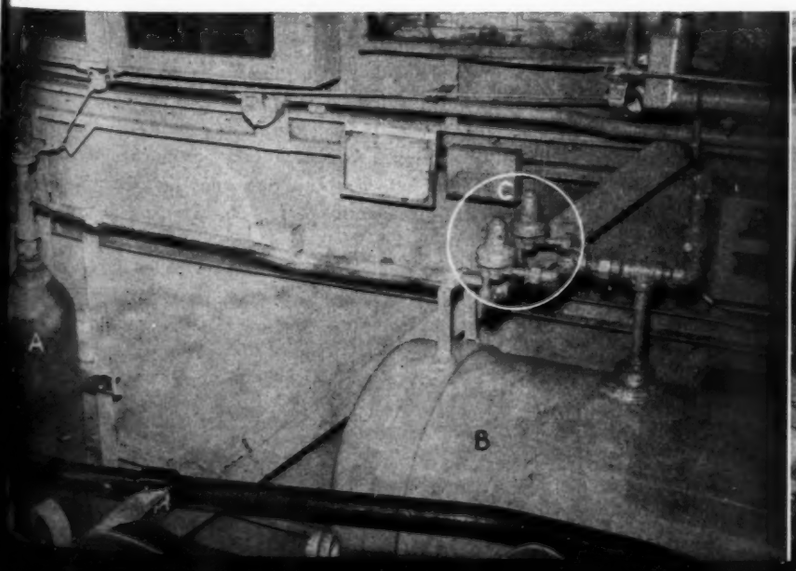
TABLE I LOCOMOTIVE FIRES

Conditions Responsible	*Number of Fires*
Crank Case Explosion	9
Brake Shoe Sparks	19
Backfire in Heating Boiler	2
Battery Charging Resistor	2
Auxiliary Generator Belt Slipping	1
Fan Belt Breaking	2
Overheated Air Compressors Cooling Pipes	1
Collision	7
Punctured Fuel Tank	2
Loose Electrical Connection	2
Exhaust Stack	4
Ruptured Oil Lines	3
Oil from Air Compressor Unloader Valve Ignited from Flashover	1
Overheated Steam Pipe under Locomotive	1
Short Circuit in Battery Box	2
Electrical Defect	1
Oil Burner Flooded	1
Traction Motor Flashover	1
	61

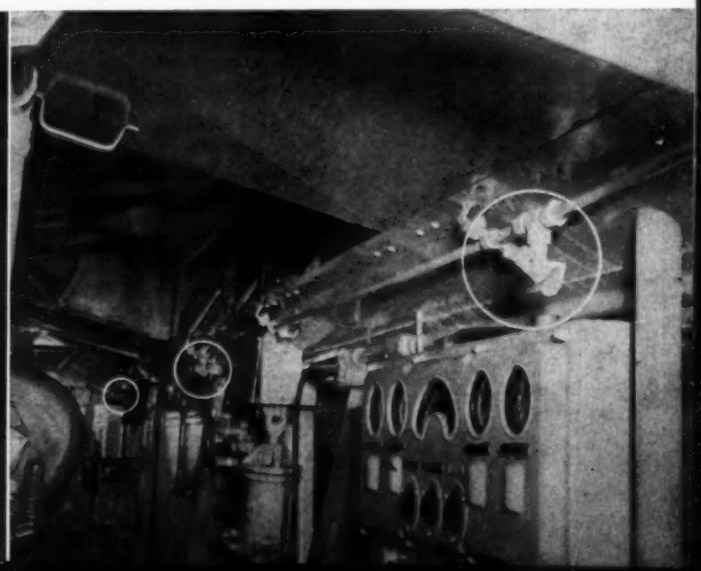
Dual control device for releasing carbon dioxide gas.



Details of foam system: (A) 25 lb. CO_2 cylinder supplies pressure to expel foam or water; (B) one of the two 60 gal. water tanks; (C) pressure reducing valves to cut CO_2 pressure to 50 lbs.



C-O-TWO baffle nozzles (circled) for flooding engine room.



NEW SMALL AIR-COOLED DIESEL ENGINES

By WILL H. FULLERTON

D. W. ONAN & Sons, Inc. has developed two sizes of small air-cooled Diesel electric generating sets. The smaller of the two sizes is a 2½ kw., single cylinder unit with a 3½ in. bore and a 3½ in. stroke. The larger model is a two cylinder opposed engine with a 5 kw. output rating, of the same bore and stroke as the single cylinder engine and with many of the parts interchangeable.

Both engines feature direct connected generator, axial flow cooling fan, pressure feed lubrication, fuel and lube oil filters and an oil bath air cleaner. The entire engine generator unit is shock rubber mounted on a welded steel base, which prevents the transmission of noise and vibration to the floor.

The single cylinder, 2½ kw. unit is unusually light weight and compact, requiring no more space and weighing no more than an equivalent gasoline engine powered generating set The weight of the unit is 370 lbs., and its dimensions are 30 in. long, 26 in. high and 20⅞ in. wide. The light weight and compactness of the unit is due to air cooling and to the use of aluminum alloy for the crankcase and cylinder.

A major departure from conventional design is made by casting the cylinder and crankcase integrally, eliminating the usual bolted together construction. The crankcase and finned cylinder are of cast aluminum alloy which permits rapid conduction of heat to the airstream by virtue of the 4:1 ratio of heat conductivity of aluinum as compared with iron. A cast sleeve is pressed into the cylinder and may be replaced should that be desirable.

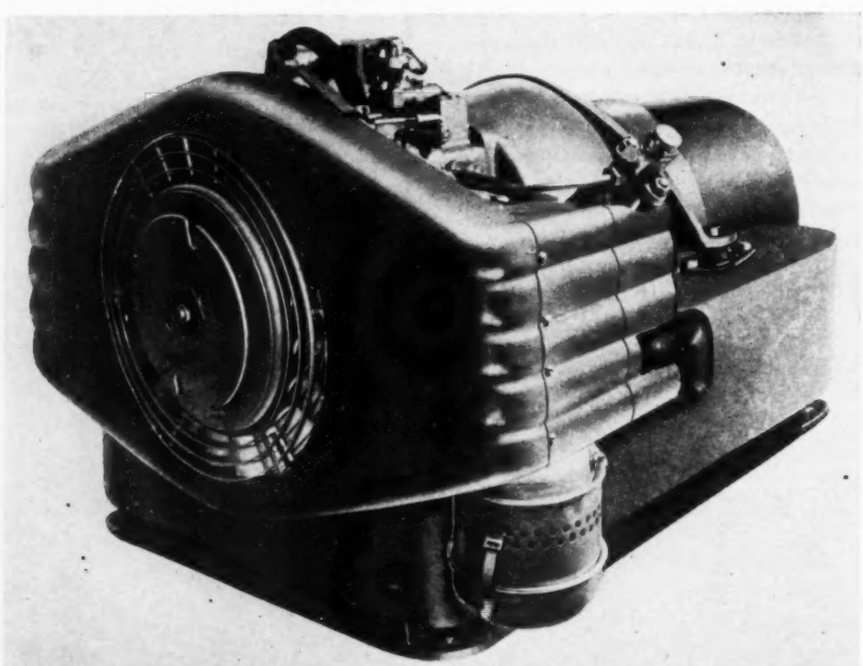
Reference to the sectional view shows the conventional straight forward layout of the two cylinder opposed type engine. The cylinder heads are cast iron and contain a pre-combustion chamber. A 17½:1 compression ratio is used. A pintle type nozzle supplies fuel to the pre-cup chamber, and individual high pressure injection pumps are mounted on each side of the cam shaft which presents a symmetrical arrangement. Aluminum main bearing liners and connecting rod bearings are employed. These aluminum bearings are of Alcoa X-750 alloy containing 7% tin.

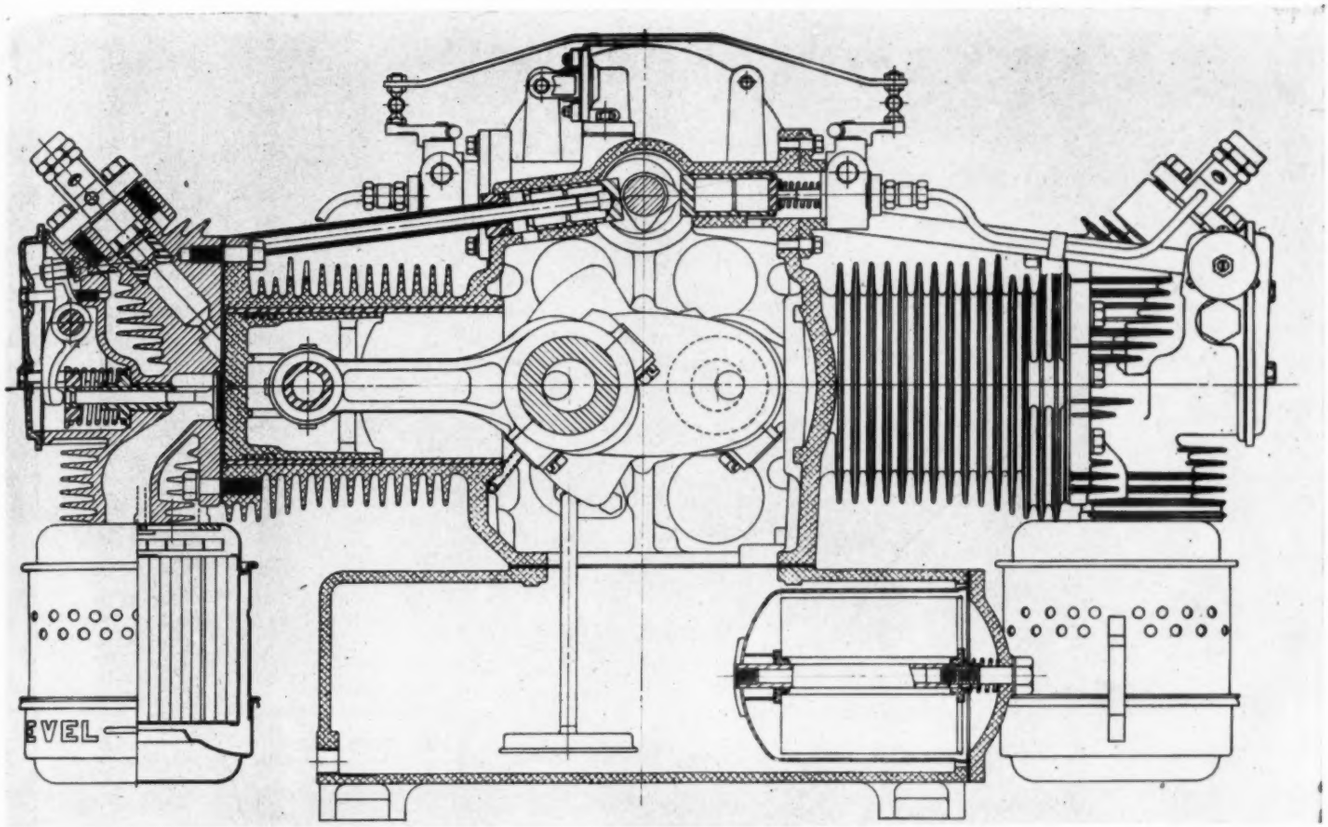
In order to obtain satisfactory cooling, an air volume of 275 cu. ft. per min. is needed per cylinder, which requires approximately .2 hp. for driving the axial fan. This type of fan presents an ideal mechanical arrangement in that it allows a simple drawn sheet metal air housing to direct the cooling air to the cylinders. This type of housing does not destroy the turbulence of the air stream which aids the cooling. It is inconvenient to provide a large fin area on the cylinder head, and for this reason it is necessary that more air be directed to it than to the cylinder. In addition to the cooling air, the cylinder temperature is controlled by the oil thrown upon it by the lubricating system. The piston ring and exhaust valve temperatures are the most critical and therefore, these parts are given the greatest attention in designing the cooling system.

Considerable attention has been given to the means of starting the engine, as this is a problem on any Diesel engine exposed to the wide temperature variations that are encountered when used in a variety of service. It is also necessary in electric generating set applications that the engine can be started by remote control circuits, or in other instances automatically, by turning on a light. An electric grid type heating element is mounted as an integral part of the oil-bath air cleaner. The induction air passing through the element is preheated just before entrance to the combustion chamber. On engines of this size that are equipped with a 12-volt starting system, the requirement for current to turn the engine is rather small, and with the standard batteries available a considerable amount of energy can be expended in preheating the induction air. By the use of the grid type heating element the temperature of the induction air is raised approximately 200° F. The heating element is connected permanently in the starting circuit of the engine so that the operator need not concern himself about switching it in or out of the circuit during warm or cold weather.

The injection equipment is manufactured by the Diesel Engineering and Manufacturing Company, and consists of a pintle type nozzle to inject the fuel into the precup chamber, and an individual injection pump for each cylinder. The quantity of fuel the injection pump delivers depends on a simple variable orifice on the suction side, which is controlled by the governor. This design simplifies the conventional control with a helical slot, rack and pinion.

Onan 2 cylinder Opposed Diesel Generating set, 12 hp., 1800 rpm., air-cooled delivering 5 kw., 60 cycle AC current.





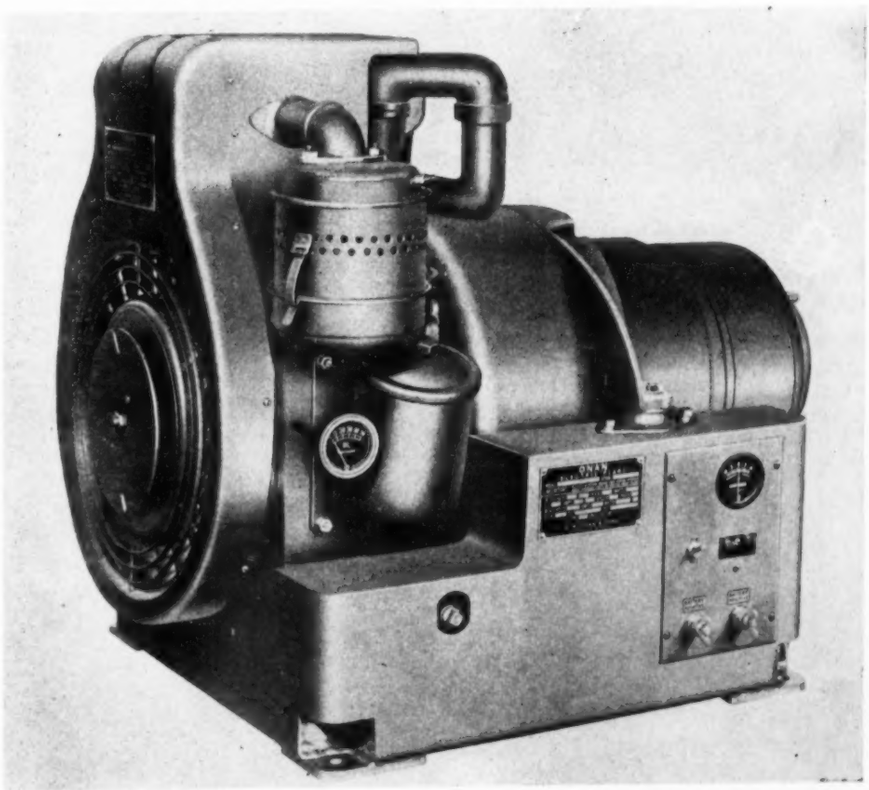
Sectional view of Onan 2 cylinder Diesel showing fuel pump and valve actuating mechanism. Demco fuel injection equipment is standard.

The injection timing is adjusted at the factory by means of a laminated shim. The injection pumps are interchangeable without affecting this timing. This simplifies replacement of pumps in the field, as it is not necessary to adjust the tappet for proper timing. The high pressure fuel line connections are made with Ermeto fittings which can easily be taken apart and do not require special tools to make a new fuel line.

A source of trouble in Diesel injection assemblies due to wear and corrosion caused by contaminated fuel has been minimized by a small two-stage fuel filter of special design that filters to three microns. The filter elements are enclosed in heavy glass bowls so that the amount of contamination can easily be seen. A fly-ball governor is built into the camshaft timing gear and is provided with external adjustments. All moving parts of the governor are lubricated from the engine oil sump. The governor provides a speed regulation of 3% from no load to full load.

There is a ready market for these compact, low cost, light weight Diesel generating sets and their availability promises to open up many new fields of application.

(Below) Single cylinder, 6 hp., 1800 rpm. Onan generating set. Weight—370 lbs.



PIKE'S PEAK DIESELS

By HARRY WALKER

WATCH for another "first" in Diesel-electric performance in mid-May when maintenance crews of the Manitou & Pike's Peak Railway clear the last snowdrift from Colorado's famous Pike's Peak to launch the road's 56th year of operation.

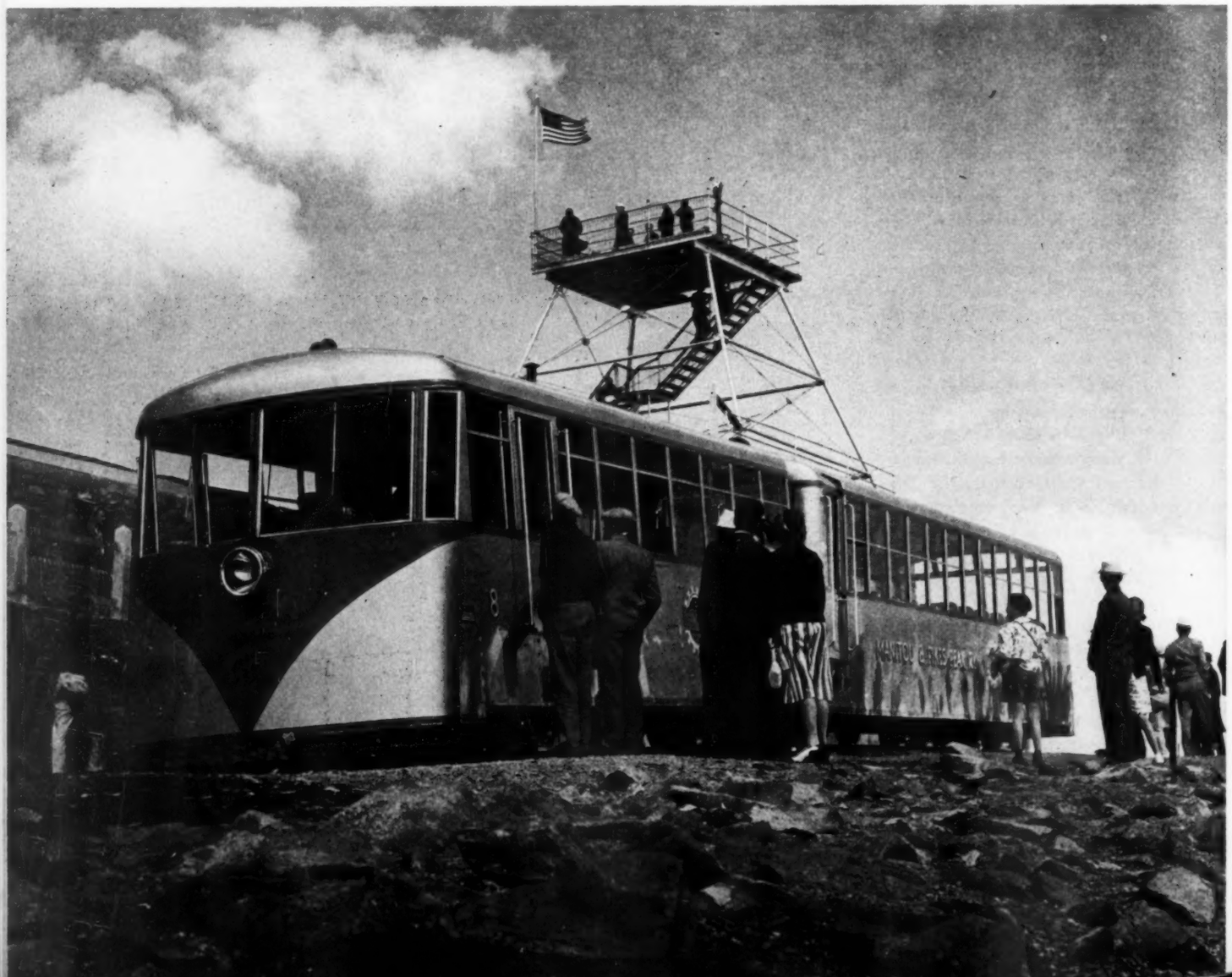
Rarin' to go on its maiden trip over the world's highest cog railway is a sleek new Diesel-electric, tailor-made by General Electric for the tortuous climb up 25 per cent grades to Summit House at 14,109 feet above sea level. "Pushed" ahead of it will be a new streamlined steel coach with a plexiglas top so that 56 passengers may have an unobstructed view of the "Switzerland of America." To appreciate the tough assignment faced by the compact little locomotive, you must first understand the topography of the route it traverses.

The trip up the peak starts from Manitou, a resort town nestled at 6,562 feet elevation. Contrary to conventional practice, the passenger car is pushed instead of pulled.

Average grade for the 8.9 mile climb to the summit is 16 per cent, with maximum grade zooming to 25 per cent at several points. One stretch just below timberline presents 1¼ miles of 25 per cent gradings. The schedule allots an hour and 40 minutes to make the trip up the twisting pike to the summit. The old steamers which still augment the "power" during peak traffic periods soak up about 6,000 gallons of water on a round trip as they hiss and pound, rock and roar, belching smoke and cinders. Stops for water have always been a headache. The road also has a six-cylinder gasoline motor locomotive built in its shops for use during rush periods.

Delivered in January (1947), the new 20-ton Diesel-electric is the second purchased by the scenic railway to better serve summer tourists. The first unit, also designed by G.E., has been in service since 1939, performing notably with its three Diesel-electric generating units and three traction motors. The power plant provides traction at the rack rail only. Each unit is rated at 160 hp. at 1,800 feet altitude—but at the top of Pike's Peak, the General Motors

At Summit of Pike's Peak, 14,109 ft. above sea level Diesel-engined railcar waits for trip down with load of wind-chilled passengers.



Starting the trip down from the peak, General Motors driven locomotive precedes the coach. Dynamic braking controls the descent on grades as great as 25 per cent.

engines deliver only about 100 hp. because of the extreme altitude.

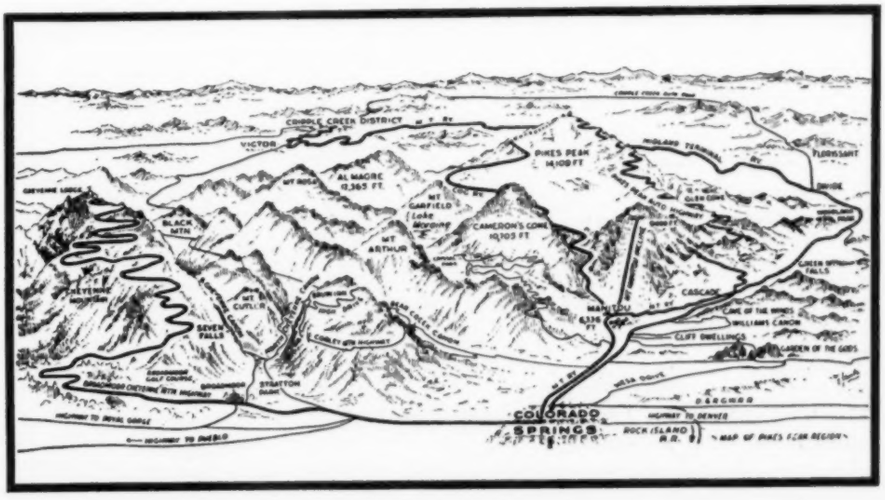
The newest locomotive is powered by two 6-cyl. Cummins Diesels instead of three engines and has two generators serving four traction motors. There are two axles. The Cummins engines are supercharged to compensate for altitude changes and are expected to be able to deliver a total of about 400 hp. in the high country. The Cummins people "pre-tested" the performance of their engines in a decompression chamber at Columbus, Ind., where atmospheric conditions identical to those at the summit of Pike's Peak were attained artificially. Generators of the newest locomotive are designed with special windings to start the engines, whereas in the earlier locomotive there was a separate starter mechanism. The cab of the locomotive is streamlined with large windows on all sides. One control station is provided and the same standard electric-drive equipment is being used as in Diesel-electric industrial locomotives. The equipment has a "dead-man" control for added safety on these dangerous grades.

On the downward trip, the locomotive simply backs down with dynamic braking holding the passenger car behind it. The new plexiglas passenger coach, built by the Winter-Weiss Company of Denver, is unique anywhere in the world. Windows begin at seat level and are full-length to the top, which features green-tinted plexiglas shaped to conform to the contour of the streamlining and affording full view of the towering peaks of the area. Another innovation is the arrangement of seats so that passengers may sit erect at all times during the steep ascent. Seat cushions are of sponge rubber, leather covered. Framework is of high tensile steel to minimize weight without sacrifice to strength. Outside panels of the coach are aluminum, riveted to the frame. The unit is 40 feet long, 9 feet wide, and seven feet high.

The railway's millionth passenger was hauled up the famous peak by the road's first Diesel-electric toward the end of the 1946 season. At the throttle was Lee Jamison, veteran of 35 years as an engineer with the cog line. It was his 7,000th trip, he estimated. The line was completed in the spring of 1891 under direction of an engineer brought from Switzerland.

The peak was discovered Nov. 13, 1806 by Lt. Zebulon M. Pike of the U. S. Army, whose expedition had tried in vain to reach the summit. He returned to Washington with the statement that it would never be ascended by man.

Panoramic map shows cog railway route as well as automobile highway running from Manitou to the peak.



DENTON, TEXAS, TURNS TO SUPERCHARGING

By DWIGHT ROBISON

IN this more or less unsettled era, when labor costs are subject to fluctuation, when building costs are almost prohibitive provided the materials could be obtained and when it is also very probable that any plant building constructed or enlarged today is going to cost far more than a similar job a few years from now, there is one angle to which efficiency-minded engineers may soundly turn in the interests of saving money for taxpayers.

That is the angle of making the most of present facilities, of getting the most production, the most value, out of present structures; getting the most efficiency and greatest power, in short, out of the smallest package. And where Diesel installations are concerned, that means supercharging.

Stepping up big Diesels with "windmills" has passed far beyond the experimental stage. Today, superchargers, properly engineered and built-in at the engine factory, are enabling many an engine to turn out the power of older machines twice their weight and dimensions. This is no secret especially in Texas, where supercharged Diesels have been installed in towboats to such an extent that predictions are freely made that in a mighty short time every tug hauling barges in the Intercoastal Canal will be driven by a supercharged Diesel. The performance of the supercharged outfits—enabling an owner to pack an eight-hundred horsepower engine into the same tug that used to be weighted down with a four-hundred horsepower job—and do twice the work with practically the same overhead—has definitely made Texas engineers intensely interested in supercharging as a solution of their space limitations problems and construction budgets.

So it was in Denton, one of the smaller Texas cities, with a population of around 13,000. The city owns its own light and power plant, and like many other communities in recent years, has seen its population and electric current demands grow far faster than its engineering planning originally contemplated.

Here's how that municipal power plant has grown: In December, 1928, the first Diesel installation was made, a McIntosh & Seymour, 800 bhp. at 200 rpm., connected to a 681 kva. General Electric generator. November, 1932, saw an addition, another McIntosh & Seymour, this one a 1000 hp. at 225 rpm. job, using a Westinghouse 895 kva. generator. And the demand kept increasing.

Four years later, two more Diesels were installed, one being another McIntosh & Seymour, 1000 bhp. at 225 rpm., connected to a Westinghouse 875 kva. generator, and the other a De La Vergne, 1000 hp. at 240 rpm., with a General Electric generator of 875 kva. Another De La Vergne was soon added, same model and power, this one using a Westinghouse generator. About four years later, in 1940, still another De La Vergne came into the plant, with 1000 hp. at 327 rpm., with a Westinghouse 800 kw. generator, and needless to say the building housing the power plant was pretty well filled up by this time. *(See Diesel Progress, September, 1941.)*

With the city continuing to call for more electricity, however, more horsepower had to be installed, and as the city of Denton was well sold on Diesel performance, of course another Diesel was in line. With space limitations and building costs being such acute problems, however, the city examined the Diesel field closely to determine upon a power plant that would fit into their picture, and concluded by turning to the engine that was setting such surprising efficiency records for Texas tugboats, the Enterprise turbo-charged Diesel.

The engine purchased and installed was an Enterprise, rated 1200 hp. at 327 rpm., connected to an Elliott generator, 2400 volts with belt-driven exciter. This Diesel is four cycle, with six cylinders, 16 in. by 20 in.; the overall length of the engine and generator combined is only 23 feet, with a height of 10 feet, and the weight is approximately 100,000 lbs.

This prime mover is supercharged with the Buchi system supercharger, built by the Elliott Company. Fuel injection is American-Bosch, with individual pumps for each cylinder. Engine accessories include a hydraulic Woodward governor with an overspeed governor also provided. A Penn alarm system is built-in; the main engine lubricator is a Manzel; the manometer is by the Marion Instrument Company. Fuel oil is filtered by a big-capacity filter made by the Commercial Filter Corporation. Lube oil is protected by a Briggs clarifier, full flow, with a capacity of 105 gpm. The pyrometer system is Alnor, with thermocouples for each cylinder and the supercharger.

This Enterprise has plenty of features which interest engineers, as they have a definite bearing on operation costs. One of these features is the use throughout of precision-type bearings, requiring no fitting nor scraping should bearing replacements become necessary. This makes for quick shop work in replacing bearings, which means low maintenance costs. Another important feature is the ability of this engine to utilize low gravity fuel.

This type of fuel is available readily at Denton at a cost of 3½c per gallon, as against the 6½c per gallon for the refined fuel oil generally used in tugboat Diesel installations, and without any complicated mathematics it is easy to figure that here's a fuel saving of nearly 50%, provided an engine is built to burn such fuel. This Enterprise will do just that.

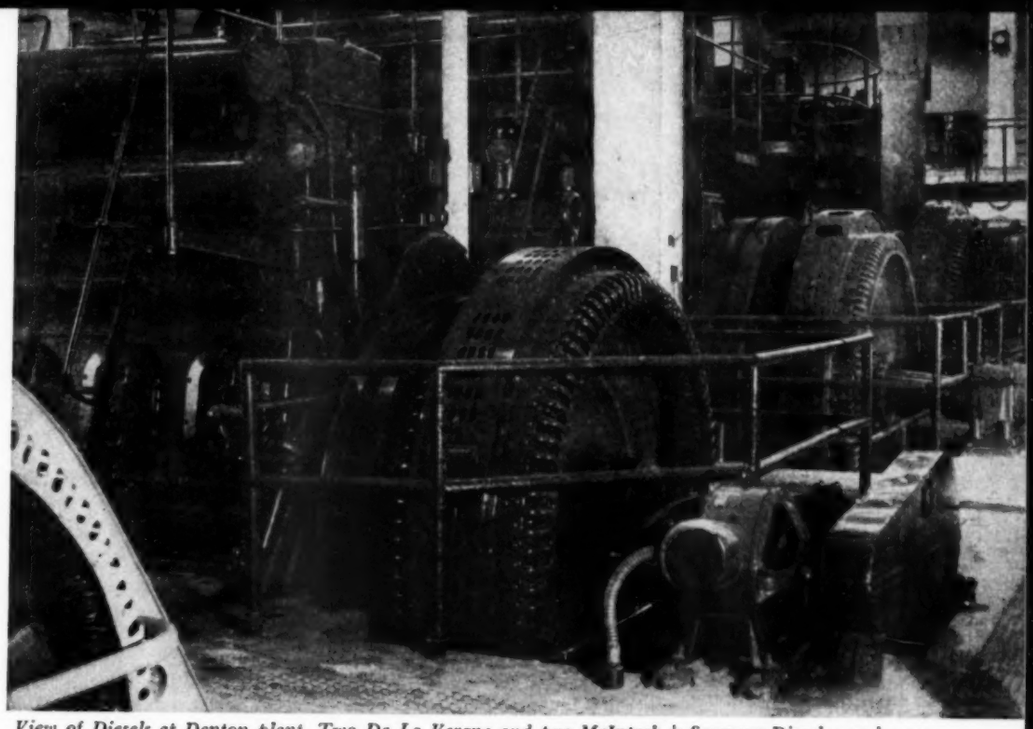
The fuel oil is heated before it enters the high pressure pumps, through an ingenious method. The cooling water from the cylinder blocks passes throught a conventional heat exchanger, into the outer shell of which is pumped the cold fuel oil, being heated to approximately 130 degrees in the process, and after this warming it burns efficiently in the Diesel. And as turbocharged Diesels are admittedly low on fuel consumption in the range from one-half to full load, the city of Denton ought to see some profitable operation from this installation.

How do they like it? How is it working out? Quoting Paul Wabnig, manager of the Gulf States area for Enterprise, "When this engine was installed, there might reasonably have been some question in the mind of the city engineer, T. S. Pennebaker. This Diesel in fact looks very small beside the machines already in service in Denton; it is approximately a third of their size and on the face of it, looks like sending a boy to do a man's job. However, weeks of operation have proved that this turbo-charged Diesel not only equals the output of the far larger, non-supercharged engines but actually puts out about 20% more power."

So they're well pleased at Denton. And in tangible token of their appreciation, they have just placed an order for another turbo-charged Enterprise, an 8-cylinder job, rated at 1600 hp. at 327 rpm., turning an Elliott generator of 1075 kw.

Yes, supercharging is here to stay in Denton, Texas. The performance of the first windmill-equipped job has settled all arguments on that score as far as the plant management is concerned.

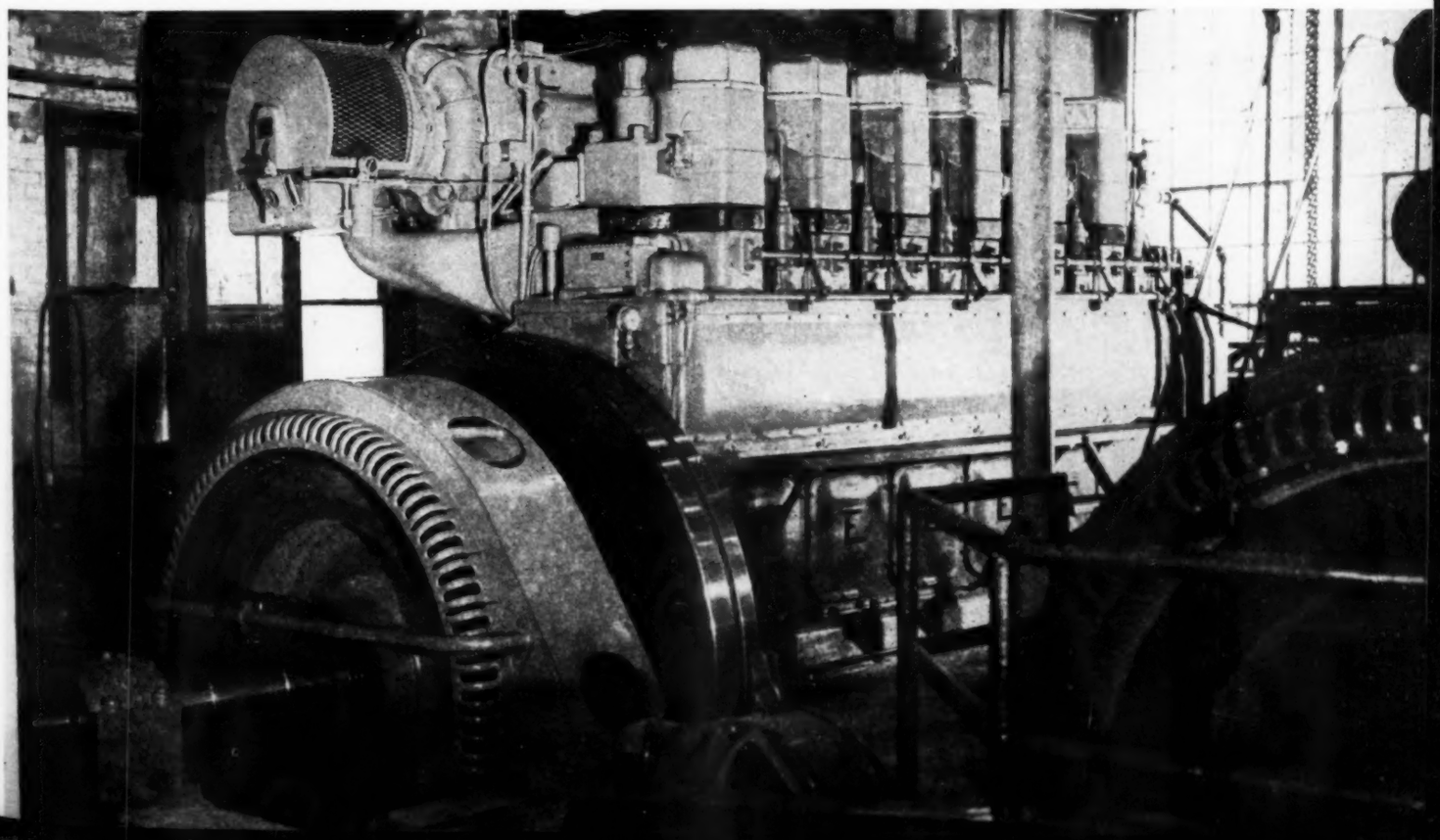
This is another example of the initiative shown by the Diesel "brotherhood" in constantly seeking new answers for power problems. It is especially true in this case where Denton's engineers found their answer only after a study covering a great range of Diesel applications, and then found it in a tugboat.



View of Diesels at Denton plant. Two De La Vergne and two McIntosh & Seymour Diesels can be seen.

Outside view of power-packed Denton plant which has recently added another Diesel.

Denton's new 1200 hp. Elliott-Buchi Supercharged Enterprise Diesel which answered the city's call for more power.



STANDARD PRACTICES FOR DIESEL ENGINES

CHAPTER SIX (Concluded)

Editor's Note: The following article is reprinted from the sixth chapter of the newly revised book "Standard Practices for Low and Medium Speed Stationary Diesel Engines" which was recently published by the Diesel Engine Manufacturers Association.

Waste Heat Recovery.—Projects for utilizing jacket water and exhaust heat should be scrutinized carefully, apart from the fundamental power plant, for potential recovery on the investment and also for their influence on the service cost and reliability of the whole plant.

The table shows typical examples of heat disposition in a Diesel engine at three-quarters to full load:

Fuel consumption, Btu./bhp.-hr.	7367
Useful work, Btu./bhp.-hr.	2545
Loss in radiation, etc., Btu./bhp.-hr.	370
To cooling water, Btu./bhp.-hr.	2194
To exhaust, Btu./bhp.-hr.	2258

This balance will vary between cooling water and exhaust for difference classes of engines, depending upon the degree of cooling applied to pistons and exhaust manifolding. For any close engineering analysis, exact figures should be procured for individual cases.

For approximate mental calculations, the quantities of heat rejected to Diesel cooling water and exhaust are equal and each is equivalent to about 2.4 gallons of water per actual hp. hr. raised through 100 F., but not all is recoverable for various reasons.

The most efficient use of waste heat is through the direct use of jacket water with heat supplemented by the exhaust. This is desirable only in closed systems such as hot water heating, since jacket water usually is selected or treated water, and cannot be run to waste.

When it is desired to make steam, an adverse condition enters. Assuming that each pound of water leaving the jacket picks up 100 Btu., it is necessary to add about 1000 Btu. to turn this same pound of water into steam. Thus only a fraction of the jacket water, primary or secondary, may be used as boiler feed and the remaining jacket water heat must be dissipated elsewhere.

The amount of exhaust heat that may be recovered is reduced to 60 per cent or 70 per cent of the total, mainly by the necessity of maintaining a final exhaust temperature of at least 250 F. to avoid precipitation of water in the system and resulting acid formation and rapid corrosion, which would occur if the exhaust gas were to be cooled below the dew point.

Every plant of this sort is an engineering project if high recovery is essential and should be so handled, as it cannot be within the scope of this chapter to give specific performance data for the wide range of conditions possible with the increasing use of waste heat recovery apparatus. Certainly all power plant heating requirements should be met by use of waste heat, although full auxiliary heating apparatus should be provided in cold regions as a factor of safety.

In moderate climates a very satisfactory way of utilizing exhaust heat is to air-jacket the exhaust pipe uptake, using it for a chimney in the summer and reversing the flow by use of a fan when heat is required.

For more complete utilization of waste heat recovery from engine exhaust, there are several types of exhaust heat boilers of fire tube, water tube and thimble tube construction, as well as finned-wall heat recovery silencers having the acoustic features of conventional mufflers. All of these are capable of producing considerable quantities of hot water and low pressure steam from the larger engine installation, when the load factor is 50 per cent or greater. The present limit for steam pressure is about 100 psi. but the efficiency is greater and the installation simplified if working pressures are 15 psi. or less.

All of the exhaust heat boilers are known to have some muffling properties, but it is not general practice to consider them as mufflers, except the heat recovery silencer type, because they may not be adequate in this respect for many localities and also because not all of them may be operated dry with safety. Some exhaust heat boilers are designed to operate dry without damage if exhaust temperatures do not exceed a certain value, approximately 800 F. In some cases conditions may require a regular muffler with blank flanged connections or a three-way swing or butterfly valve in the piping so that the exhaust can be made to flow through either the boiler or the muffler as desired.

Individual boilers are recommended for each engine.

All exhaust heat boilers should come equipped from the manufacturer with standard "boiler trim," namely, pressure gage, water gage, try cocks, safety valve and surface and bottom blow-off valves. The boiler manufacturer should be informed as to:

1. Engine specifications, i.e., make, model, cycle, bore and stroke, number of cylinders, horsepower, rpm., average load, weight of exhaust gas in pounds per hour, exhaust temperature range, and permissible exhaust back pressure.
2. Temperature and quality of available feed water.
3. Final temperature of water or pressure of steam required.
4. Quantity of hot water or steam required per hour.
5. Location (with respect to engine).
6. Type of automatic heat recovery controls required.
7. Type of condensate return system required.
8. Whether boiler is to be insulated and, if so, what type.
9. What boiler accessories are required in addition to the standard "boiler trim."
10. What state laws, local ordinances or regulations govern construction and installation of such pressure vessels, in addition to ASME Code requirements, and what permits are required.

Starting Air Systems.—All engines are not designed to require the same air pressure for starting. These quite legitimate differences in starting air pressures result in air tanks of varying constructions and cubical contents and in the use of starting air compressor sets of different sizes and operating pressures. These variations imply no difference in ease of starting

. . . . *And now please turn to page 102* . . . .

"NEPTUNE I" ALL STEEL FISHERMAN

SAID to be the first all-steel combination purse seiner and tuna boat afloat in San Francisco Bay, the 82-foot *Neptune I*, built and launched by the Heo Boat Company at Oakland, California, is now fishing out of San Pedro. The *Neptune I* was designed as a year-round fishing boat and has many new features of design and equipment. The boat is owned by K. Hovden of Monterey, H. E. Ottenbreit, W. C. Crittenden, and A. Simmon of San Francisco.

She is an all steel welded purse seiner of 82-foot length, 21 ft. 6 in. beam, and 10 ft. 6 in. draft. It carries 175 tons of pay-load and has an 18,000 mile cruising range at better than 11 knots. Generous use of high tension corrosion resistant steel has resulted in a saving of weight and is expected to reduce the maintenance expense due to rust. The general construction is along dreadnaught lines with a bulbous bow, a raised pilot house, and a flying bridge. Besides the saving in weight, the steel construction has other advantages in that more space is obtained in the fish hold when brine tanks are used due to the fact that the tanks can be built out to the wall without an air space as is customary, to avoid dry rot, in wood construction. There are ballast tanks aft which are used to trim the ship allowing the stern to be lowered while working with the nets, regardless of the load in the hold. Wing tanks in the side of the vessel provide control of the list which is very helpful during brailing operations. The use of these wing tanks also eliminates the center line spreader board which is normally used to keep the load from shifting. There is a capacity on board for 7,000 gallons of water and 18,000 gallons of fuel, and the fuel is transferred by an electric transfer pump to a 400 gallon day tank. There is also a 250 gallon lube oil tank.

The *Neptune I* is powered with a General Motors Twin Diesel engine comprised of a matched pair of 2-cycle, 6-cylinder Diesel engines mounted on a common steel sub-base and geared to one 5 in. propeller shaft. Each engine is coupled to its driving pinion through a clutch which allows either engine to be cut in or out of operation while running, thereby imparting a degree of security not to be found in more conventional propulsion units. Either engine can drive the ship at about 2/3 speed. The engines are fresh water cooled by built-in heat exchangers, and they are fully protected by an alarm system against low oil pressure or high water temperature. Adel hydraulic controls make operation from the engine room, crow's nest, wheel house, or bridge equally convenient.

This twin engine, supplied by the Bay Cities Equipment Company, is rated at 300 hp. With the present reduction gear, a 63 in. propeller is turned at 320 revolutions. The boat is soon to be powered with a General Motors Quad engine consisting of four 6-cylinder engines driving a common shaft through a 4:1 reduction gear. This will double the horsepower to 660, and is expected to turn the same propellor 400 revolutions per minute. Trial runs indicate a speed of over 11 knots will be used for cruising.

The compact arrangement of these 2-cycle Diesel engines has eliminated much of the weight and bulk usually found in engines of this horsepower class, and has resulted in many worthwhile features, among which is the saving of from 8 to 10 feet of hold capacity and of about 9 tons in weight.

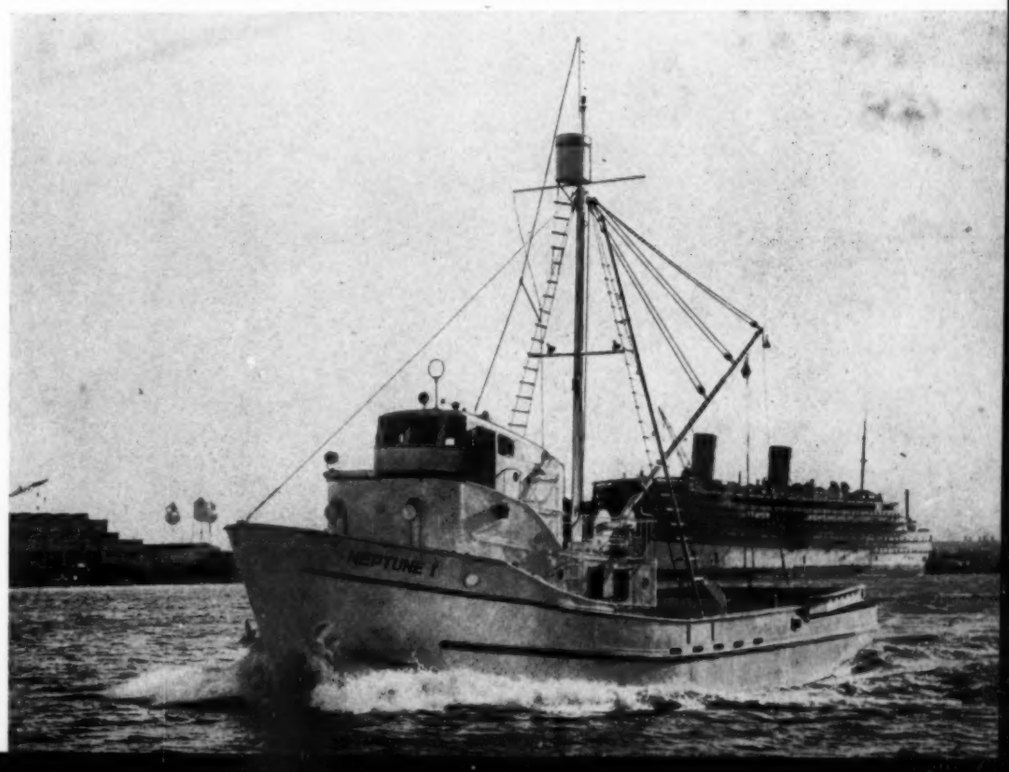
The ease with which this engine was installed, the process requiring but one hour, using the ship's own boom, is typical of the careful planning that has gone into this design toward reducing maintenance expense. In a matter of hours, replacement engines may be installed and the old ones reworked at leisure under most favorable conditions, thereby avoiding the costly tieups at major overhaul periods. The deck house is luxuriously paneled in hardwood and equipped for a twelve-man crew. It is completely insulated with fibre glass. More than the usual number of flood lights are provided for working the nets at night.

Modern equipment aboard includes the following: Sperry Gyro Magnetic Compass and power steering; 25 hp. electric winch as well as the 5 hp. electric anchor windlass, built by the Heo Boat Works and are supplied by a 50 kw. Westinghouse generator driven by a General Motors Diesel engine supplying 120 volts DC throughout the ship.

The propellor shaft is 5 in. diameter, Tobin Bronze, running in a Goodrich cutless bearing, and the propellor is a bronze Doran type "D."

The rudder provides for counter steering and is supported on thrust bearings on both top and bottom. Both the wheel and rudder can be changed at sea. The engine room is protected by a Walter Kidde CO_2 equipment. The galley has a Lang oil range and a Frigidaire. Both fresh water and sanitary pumps as well as the bilge pump can be cross connected and used for fire pumps.

"Neptune I," all steel welded purse seiner equipped with General Motors Diesels. Modern in every detail, she has a Sperry Gyro-Magnetic compass.



OIL PURIFICATION FILTRATION AND RE

Editor's Note: The article reprinted below is presented as a concise and accurate study of the problem of lubrication oil care and treatment. It presents the problems of oil purification, filtration, and reclamation clearly to the reader with an eye towards the needs of the operating engineer. The articles originally appeared in the January 1947 issue of Lubrication *published by the Texas Company.*

EXTENDING the useful life of lubricating oil has been and continues to remain an important part of good equipment maintenance. While methods of oil purification, filtration or reclamation will assist materially in prolonging the useful life of lubricating oil, a more important requirement is proper application of the right type of lubricating oil to a given piece of equipment. Supplementing this, and equally important, is the necessity for operating and maintaining equipment in accordance with the instructions issued by the manufacturer. If the right type of lubricating oil is applied to equipment which is properly operated and maintained, the oil will provide satisfactory performance for relatively long periods of service before replacement of the oil is desirable.

Even though lubricating oil is accorded good treatment through proper operation and maintenance of equipment, it nevertheless deteriorates and/or becomes contaminated after extended periods of use. This is dependent, of course, upon the type and severity of service. The method used for purification, filtration or reclamation of the used oil and whether this should be done during operation or after removal of the oil from the system, require individual consideration, since obviously the cost of oil life extension must not exceed the value of the amount of new oil to be purchased if one of the methods is not used. The following discussion is presented to assist the operator of equipment to better evaluate his own particular problems of lubrication.

* *Technical and Research Division, The Texas Company.*

Characteristics of Used Oils

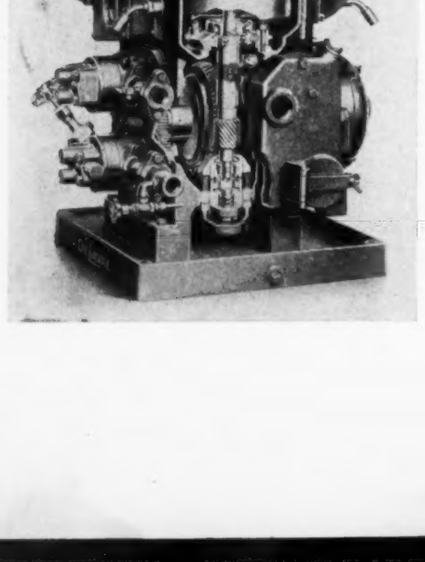
Used oils are characterized by one or more of the following conditions:

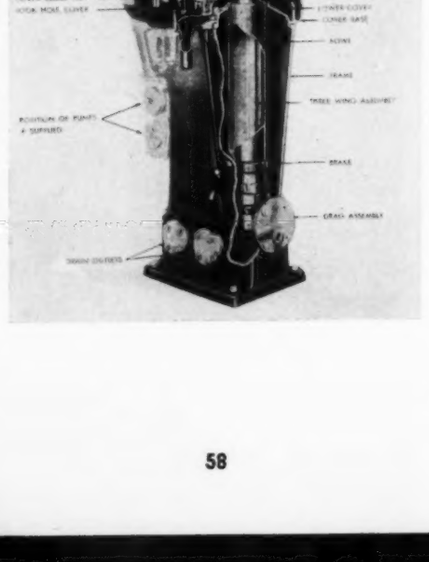
1. Oil which has deteriorated due to oxidation in the presence of air or other oxygen-containing media, accompanied by high temperature service. Products of oxidation may be soluble or insoluble in the used oil depending upon the degree of deterioration.
2. Oil which has deteriorated due to polymerization (linkage of unsaturated oil molecules to form progressively heavier molecules causing oil thickening), a result of high as well as normal temperature service. Products of polymerization may be soluble or insoluble.
3. Oil which has been contaminated with extraneous matter. Products of contamination include:
   (a) Dirt and dust common to region in which equipment operates.
   (b) Core sand that has remained in metal castings from the time they were formed in the foundry.
   (c) Metal particles from the time equipment was in the machine or repair shop.
   (d) Metal particles due to disintegration or wearing of parts such as bearings, piston rings, etc.
   (e) Carbon and other products of partial decomposition or oxidation resulting from destruction of oil or incomplete combustion of fuel.
   (f) Water and anti-freeze.
   (g) Dilution with fuels.
   (h) Miscellaneous, such as paint, asbestos, linseed oil, etc.

If used oils are to be continued in service, the products of oxidation and polymerization and any foreign contaminants should be removed. There are many ways of removing such materials from oil, but all fall into three basic types of equipment:

1. Gravity purification methods, such as gravity settling and centrifuging, which are capable of removing only insoluble materials.
2. Filtering equipment which can remove insoluble matter and some soluble products depending on type of media.
3. Reclaiming methods which not only can remove insoluble materials, but are also capable of removing varying amounts of soluble products depending upon equipment design and operating conditions.

(Left) Sectional view of the DeLaval "Uni-Matic" oil purifier. (Right) Details of the Sharples Super-Centrifuge with parts identified.





Gravity Purification of Lubricating Oil

Methods for gravity purification of lubricating oils include simple gravity settling followed by decantation and/or treatment by centrifuging either wet or dry.

The simplest means of effecting some degree of purification of used lubricating oil is to permit the oil to rest in a settling tank for a period of time. During this time, and depending on temperature and efficiency of settling and decanting facilities, it is generally possible to remove the major part of the suspended insoluble oxidized material, foreign particles, dirt and water. Separation of such oil contaminants is made by gravity alone, and is adversely affected if stable emulsions exist.

Settling is most effective in horizontal tanks

RECLAMATION

By BRIAN CORRIGAN*

with vee shaped or sloped bottoms and having either jacketed walls or steam coils for heating the oil to proper temperature. Depending on oil viscosity, best results are obtained at oil temperatures of 120-160° F. Obviously, excessive temperatures should be avoided to prevent the acceleration of oil oxidation. It is to be noted that practically no settling will occur while the oil is being heated because of the convection currents created. Also, settling at low temperatures should be avoided because the rate of separation is slowed up due to the higher viscosity of the oil.

Disadvantages of purifying oil by settling and decantation are as follows (assuming equipment for which oil is required has to operate continuously):

1. Two complete batches of oil are required.
2. It is generally necessary to shut the machine down to change the oil.
3. Considerable space is required for settling tanks.
4. At least ten days are usually required for satisfactory clarification.
5. While oil is in service, impurities are not removed as they collect, but are permitted to build up to some predetermined concentration at which time the batch is withdrawn and purified.
6. Purification is not complete. Those insolubles which are close in gravity to that of the oil cannot be removed by this process.

Purification by this method is adaptable to all straight mineral oils such as those used for lubricating Diesel and gas engines, air and refrigerating compressors, steam turbines and general plant equipment. It is important to realize that oils so handled are only partially clarified. They may still contain soluble oxidation and polymerization products as well as amounts of fuel dilution, depending on the type of service involved. Heavy-duty, additive-type oils cannot be purified by this method with any degree of success because of their dispersion characteristic. This property prevents agglomeration of insoluble contaminants with the result that settling of these materials is all but impossible.

Treatment by Centrifuging

Purification by centrifuging employs the same basic principle as settling and decantation, but is faster and more complete because the separating force is several thousand times that of gravity. The centrifuge or centrifugal separator is a device for freeing the oil of suspended insoluble oxidized material, foreign mineral and carbonaceous matter, dirt and water. Centrifuging wet, if started on new oil, will keep the accumulation of acids in the oil at a very low level. As with settling and decantation, a centrifuge will not separate liquids which are mutually soluble, such as fuel in lubricating oil. Likewise this method of purification will not remove colloidal foreign matter, particularly from heavy-duty engine oils with dispersant properties.

In selecting a centrifuge for use on a by-pass in a circulating system, it is best to choose one having a manufacturer's rated capacity sufficient to handle all of the oil in the system in some three to six hours. This is based on the assumption the centrifuge will be operated either continuously or intermittently on oil batches.

When centrifuges are used for oil purification, they should always be set to operate by the two-liquid discharge method. This does not necessarily mean that water should be added to the centrifuge, but a discharge opening should be provided to emit any water which may get into the oil system.

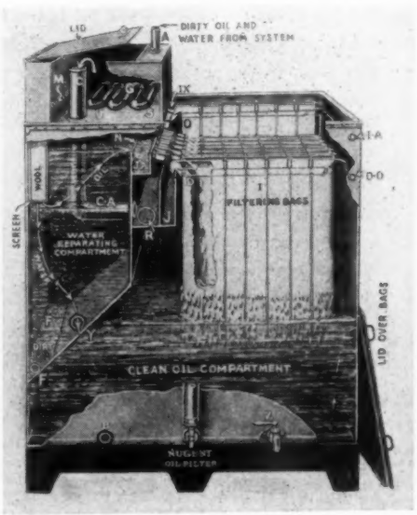
The terms "wet" or "dry" centrifuging are used to indicate whether or not water is intentionally added to the oil at the centrifuge. Although it is somewhat inconvenient, cleaner oil will result by the addition of water to the oil at the centrifuge under proper operating conditions. Care must be taken to be sure stable emulsions are not formed as a result of introducing water at the centrifuge. Centrifuging wet has the following advantages:

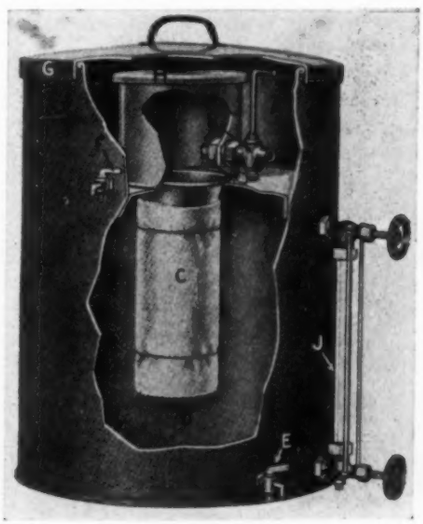
1. The water has a washing effect, aiding in the removal of impurities.
2. The water carries away most of the lighter insoluble impurities which have gravities approximately the same as that of oil, permitting longer runs between cleanings.
3. Some acids, particularly when freshly formed in lubricating oil, are more soluble in water than in oil and are thus removed, as are mineral acids.
4. In many cases of corrosion of centrifuge bowl parts in service the corrosive attack has been markedly diminished, or entirely stopped, by feeding a small amount of fresh clean water, continuously into the centrifuge, thus diluting and washing out salt and acidic contaminants. This is particularly true for marine turbine and Diesel installations.

The objections to wet centrifuging are:

1. Due to the greater density of water, the water discharge must be of a greater diameter than the oil discharge to permit water to flow out of the centrifuge. Accordingly, if the water

(Left) Details of the Nugent oil filter showing direction of oil flow. (Right) Bowser batch filter showing component parts.





COMPARISON OF PURIFICATION, FILTRATION AND RECLAMATION METHODS

	GRAVITY PURIFICATION			FILTRATION			RECLAMATION	
	Gravity Settling	Centrifuging Dry	Centrifuging Wet	Mechanical Filters	Absorption Filters	Adsorption Filters	Clay-Type Reclaimers	Chemical Treatment
Filtering Media	....	....	....	Inactive	Inactive	Active	Active	Active
Application to Systems								
Full-Flow	No	No	No	Yes	Not generally	Not generally	No	No
By-Pass	No	Yes	Yes	Yes	Yes	Yes	Sometimes	No
Batch	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Contaminants Removed								
Insoluble Solids								
Large particle size	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Small particle size	No	Some [4]	Most	No	Yes	Yes	Yes	Yes
Insoluble Oxidation Products								
Agglomerated	Some	Most	Yes	Some [2]	Yes	Yes	Yes	Yes
Dispersed	No	No	Some	No	Some	Yes	Yes	Yes
Soluble Oxidation Products	No	No	No	No	No	Most [3]	Yes	Yes
Water & Water Soluble Materials	Yes	Yes	Yes	No	Some	Some	Yes	Yes
Removal of Oil Additives	No	No	Some [4]	No	No	Some [5]	Yes	Yes

[1] Providing gravity heavier than oil
[2] Depending upon size of agglomerates
[3] Depending upon type of media
[4] Only those which are water sensitive
[5] Depending upon type of additive

seal breaks, oil will flow out of the lower discharge instead of the oil discharge.

2. If periodic cleaning of the centrifuge is neglected, the dirt holding space may become filled with oil contaminants and water. When this occurs the bowl overflows and dirt and water are not removed from the oil.
3. Clean oil and water will not normally emulsify. If the oil becomes unusually dirty, emulsion difficulties may occur. In such cases the amount of water should be decreased, the oil temperature increased, or the oil feed rate temporarily reduced until satisfactory separation is again obtained. Normally a centrifuge will break an emulsion which is not too stable.
4. Certain types of additives used in heavy-duty Diesel engine oils and in inhibited turbine oils tend to concentrate at an oil-water interface with the result that at least a portion of such additives will be removed.

The results of purifying used lubricating oils by centrifuging are the same as those accomplished by settling and decantation, but in a more efficient and less time-consuming manner.

Lubricating Oil Filtration

Oil filters are of many types and when used are almost always installed in connection with the equipment being lubricated. Such filters are generally used in the forced-feed lubricating systems of internal combustion engines regardless of the type of service.

Oil filters under this heading are composed of housings in which removable elements or cells may be placed. When elements become partially clogged with oil contaminants, they can either be removed and cleaned or replaced with new elements, depending on type. Such an installation makes for simplicity in maintaining reasonably satisfactory oil performance. There is another type of oil filter composed of a housing and element in one unit. When this type becomes clogged, it is necessary to replace the whole assembly.

Depending on the kind, oil filters are capable of removing insoluble oxidized material, foreign mineral and metal particles, carbonaceous matter, water and dirt, and in certain cases some soluble oxidation products. Oil filters will not separate mutually soluble liquids, such as diluent or fuel from lubricating oil. Types of oil filters may be classified as follows:

1. Metallic or mechanical (edge-type, copper ribbon, steel wool, screen, strainer). Filters of this type remove coarse contaminants such as metal chips and particles of grit and scale by means of closely woven metal screens. Removal of insoluble oxidized material is generally not effected unless the size of such particles is sufficiently large to be caught by the filter element openings. Soluble oxidized material, finely divided carbon particles, water, dust and finer insoluble oxidation products cannot be removed by such filters.
2. Absorbent (cotton waste, wood pulp, wound yarn, felt, flannel, cloth, paper, mineral wool, quartz, diatomaceous earth, asbestos). Filters of this type not only remove coarse contaminants but also aid in the removal of finer insoluble particles such as carbon, dust and insoluble oxidized material. Certain of these filters remove mineral acids as well as water. Soluble oxidation products are not removed. Filtration is accomplished by adhesion of contaminants to element structures, and absorption by the components of the filter due to porosity.
3. Adsorbent (Fuller's earth, boneblack, charcoal, other active type clays—chemically treated paper and waste). In addition to removing coarse and fine contaminants, filters of this type are capable of reducing the amounts of soluble oxidized material and water to a limited extent. Such filters remove oil contaminants not only by mechanical means, but also as a result of chemical action and adsorption. Adsorbent filters may remove chemical additives blended with certain oils to improve performance characteristics, but this is not true in all cases.

Oil filters may be installed in either of the following ways:

1. Full flow: One receiving total oil supply from pump discharge. Metallic or mechanical type filters are generally used for this purpose.
2. By-pass: One receiving only a portion of the oil circulating in the system. Absorbent and adsorbent type filters are generally used for this purpose.

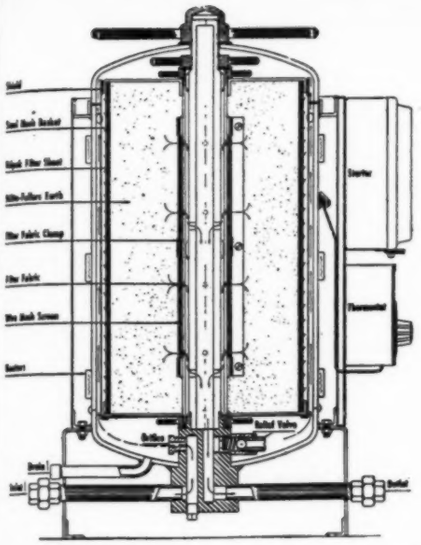
It should be pointed out that practically all types of filters are equipped with means of bypassing the oil when filter clogging occurs. Oil filtration is almost always employed in conjunction with internal combustion engine installations and is also used to some extent in connection with other equipment. For instance, filters of the absorbent or adsorbent types are sometimes used to supplement methods of oil purification (batch or centrifuge) in turbine installations. Where large oil storage facilities are available, metallic or mechanical type filters are generally used in the lines between tanks and equipment to be lubricated. Oil filters may be used in any lubricating system where sufficient pressure is available to force the oil through the filtering medium.

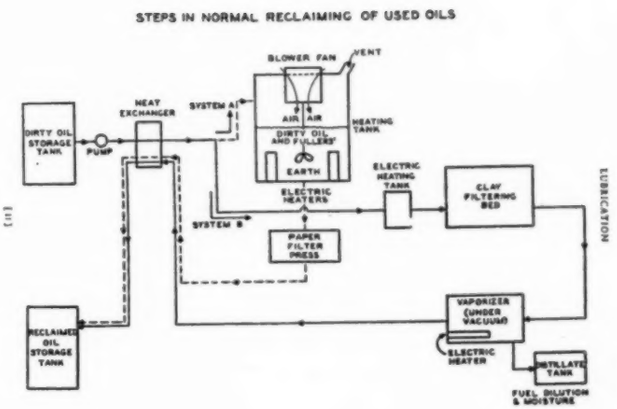
Lubricating Oil Reclamation

Used lubricating oils can be reclaimed or refined by a variety of methods, the more important of which are described in the following:

High Temperature Clay-Type Oil Reclaimers

In the high temperature clay-type oil reclaimer oil is purified by contact with Fuller's earth or similar activated clays. This can be done in batch or by continuous treatment. These reclaimers remove most of the solids present in used lubricating oil such as mineral matter, dirt and carbonaceous material. Soluble oxidation products, which are responsible for varnish and lacquer formations on hot engine surfaces, are reduced to an extent varying with clay efficiency, clay to oil ratio and operating conditions. This reclaiming method also reduces the amounts of water and organic acidity which may be present in the used oil. In this process the oil is often heated to 400° F., and in some reclaimers even higher under vacuum, which means volatile liquids such as gasoline are substantially removed. If used oil is contaminated with Diesel fuel, however, only a portion of the fuel can be removed unless the reclaiming temperature is raised considerably above 600° F. Reclaiming at this temperature, however, may volatilize some of the lighter lubricating oil ends which will pass off with the diluent. High





(Left Hilco Hyflow oil filter showing Fullers Earth element. (Center) Schematic layout for the reclaiming of used oil. (Right) Cut-away view of Honan-Crane continuous oil purifier. (Below, right) Bowser combination oil filter and storage tank.

temperature clay reclaimers will also remove most chemical materials which may have been added to lubricants to improve certain performance characteristics. For this reason clay type reclaimers should not be used to reclaim used additive oils unless the reclaimed oil is relegated to some service not requiring heavy-duty or additive type lubricants.

There is no limit to the amount of used oil which can be reclaimed by this general method, providing several units are in use. If the used oil is in fairly good condition, the amount of oil reclaimed will approximate the maximum rated capacity of the unit. If, on the other hand, the oil is badly contaminated and oxidized, the flow rate may be as low as 50 per cent of the maximum rated capacity. The presence of water or chemical additives in the oil may reduce the flow rate appreciably. The flow rate will also be influenced by the clay to oil ratio. The percentage of oil recovered from the reclaimer will vary from 50 to 95 or more per cent of the oil charged, depending upon reclaimer design, condition of the oil, amount of clay used per gallon of oil, and method of operation.

Advantages of using high temperature clay-type reclaimers are:

1. When this process is applied to straight mineral oils, and properly carried out, it is generally possible to produce a reclaimed oil having physical tests approximating those of the original product. This does not imply that reclaimed oil is equivalent to new oil in actual service.
2. While the reclaimed oil is not as satisfactory as the original oil, this is partially compensated for by the fact that where reclaiming units are installed, the oil is generally changed and reclaimed more frequently so that the average oil condition is maintained at a reasonably good standard. Addition of new oil as make-up also improves the quality of the reclaimed oil.

Disadvantages of this type of process are:

1. Quality of reclaimed oil is not as good as new oil from performance point of view.
2. In small installations where the amount of oil involved is small, or even in larger installations where the oil is not rapidly contaminated or oxidized, the high first cost of the reclaiming equipment may not be justified. Also operating costs, including cost of clay and extra manpower, may not be warranted. In such instances more economical lubrication can be obtained by periodic oil change.
3. More highly skilled personnel are required to properly handle reclaiming of used oil than are necessary for changing oil.
4. The reclaiming process cannot be applied to oils containing additives unless use can be found for the reclaimed oil in applications where the presence of additives is unnecessary.

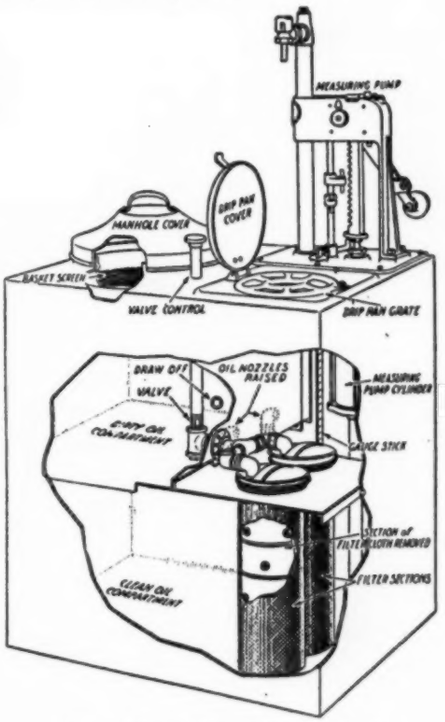
Reclaiming of Oil by Chemical Treatment

The reclaiming of oil by chemical treatment is generally carried out in connection with clay treatment by either of the following methods:

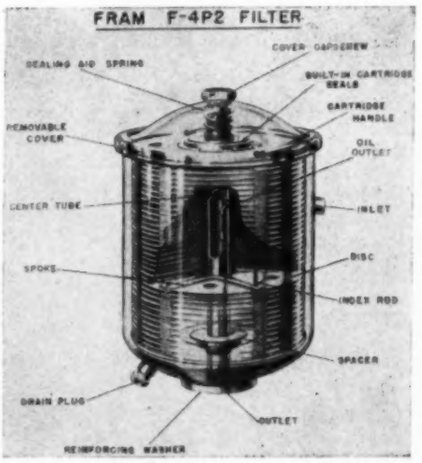
1. Treatment with alkaline or caustic solutions.
2. Acid treatment followed by caustic or clay neutralization.

As these two chemical treatments are both used in the refining of new oil, it is to be expected that better reclaimed products can be produced than from other methods of oil purification and reclaiming. The procedures, however, are much more complex and trained personnel are re-

. . . . *And now please turn to page 74* . . . .



Fram Filcron filter showing details.



AIRCRAFT DIESELS IN SOVIET RUSSIA

By PAUL H. WILKINSON

RECENT disclosures reveal that Soviet Russia has been building aircraft Diesels far more powerful than those now produced in other countries. As long ago as 1941, aircraft power plants with compression ignition were in small series production in the U.S.S.R. to meet the need for economical heavy-duty long-range aircraft for transport duty.

An outstanding example of the progress made by the U.S.S.R. in the field of the compression ignition aircraft engine is to be found in their powerful M-40 Diesel. This is a 12-cylinder vee-type liquid cooled power plant, equipped with turbo-superchargers for take-off with heavy loads and for high-altitude operation. Designed for 4-cycle functioning, the M-40 bears some constructional resemblance to the Mercedes-Benz OF-2 airship Diesel developed in Germany about 1934. The Russian engine is far more powerful, however, and is designed for use in heavier-than-air craft.

The M-40 aircraft Diesel has a 2-piece heavily ribbed aluminum alloy crankcase. The lower portion of the reduction gear housing is integral with the upper portion of the crankcase. The two cylinder blocks, set at an angle of 60 degrees, are made of aluminum alloy and they are fitted with removable steel liners. The detachable aluminum alloy cylinder heads have flat top combustion chambers, with four equally spaced valve seats. The two inlet valves and the two sodium-cooled exhaust valves per cylinder are actuated by two overhead camshafts driven by means of bevel gears and drive shafts at the rear of the engine. The cylinder blocks and cylinder heads are secured to the crankcase by fourteen long stud bolts passing through each cylinder head.

The crankshaft is machined from a solid steel forging, without counterweights. It is supported in seven plain bearings. It has six throws to which are secured marine-type (master and auxiliary) connecting rods machined from H-section steel forgings. As one rod of each pair is pivoted on the other rod, this makes the stroke from one bank of cylinders 0.35 in. less than that from the other bank, thereby maintaining the same compression ratio in both banks. The aluminum alloy pistons have cooling pins integral with and inside their crowns. A reduction gear pinion attached to the front end of the crankshaft meshes with a larger herringbone-type gear wheel with cushion-spring drive attached to the rear end of the hollow propeller shaft. This provided a reduction gear drive with a ratio of 1.43:1 (0.70:1).

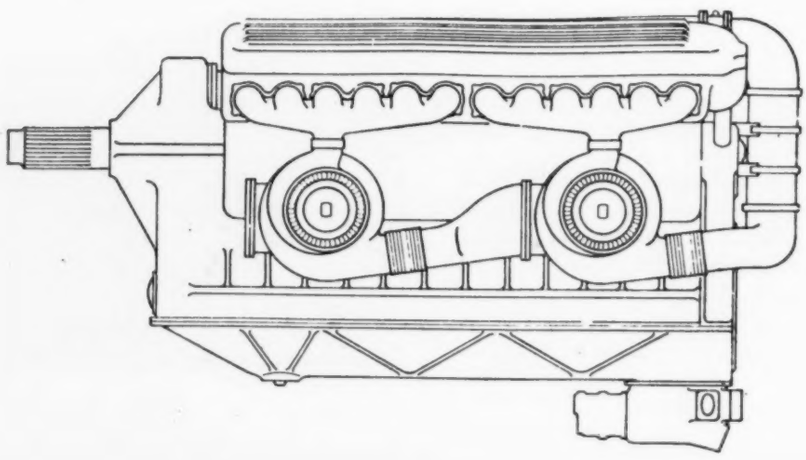
The engine is remarkably well supercharged with four turbo-superchargers, two of them being located on the outside of each cylinder block. Each turbine wheel is driven by the exhaust gases from three adjacent cylinders and is direct-coupled to the 12-vaned impeller of a centrifugal type compressor. The two compressors on each side of the engine are connected in series so that a two-stage effect is obtained before the air passes through large-diameter manifolds to the intake ports located along the inside of the cylinder blocks. The speed of the turbine wheels is controlled by by-pass gates, and the air flow after it has left the compressors is controlled by butterfly-type throttle valves in the manifolds to the cylinders.

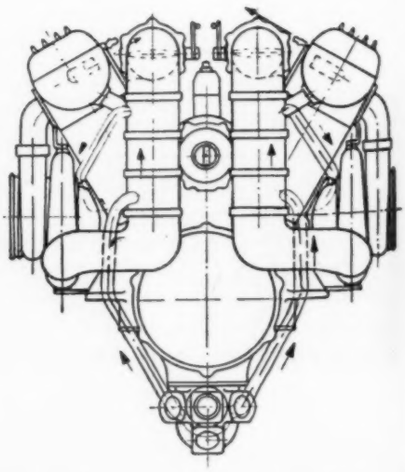
The direct fuel injection system comprises two 6-unit in-line Bosch type high-pressure pumps mounted one behind the other in the vee between the cylinder blocks, where they are driven from the same auxiliary shaft from which the camshaft drives are taken. One spring-loaded closed-type injector nozzle is fitted in the center of each cylinder head. The maximum injection pressure is approximately 1,600 lbs. per sq. in. The lubrication system is of the conventional pressure-feed type, with dry sump, and it operates at a normal pressure of 70 lbs. per sq. in. One pressure pump and two scavenge pumps are used. The cooling system embodies a duplex pump with a separate circuit for each cylinder block. The starting system uses compressed air with a small compressor mounted on the engine.

The M-40F, which is one of the more recent production models of the series, has a bore of 7.09 ins. and strokes of 7.87 ins. and 8.23 ins., giving it a displacement of 3,802 cu. ins. Its compression ratio is 13.5:1. The width of the engine is 43.3 ins., its height is 49.2 ins., and its length is 86.6 ins., and it has a frontal area of 10.4 sq. ft. Its weight is 2,645 lbs., and its specific weight is 1.76 lbs. per maximum hp.

The M-40F is rated at 1,500 hp. at 1,950 rpm. for take-off, with 50.9 ins. (+10.5 lbs.) boost. Its maximum rating is 1,250 hp. at 1,950 rpm. at 19,700 ft. altitude. Its normal rating is 1,100 hp. at 1,800 rpm. at 16,400 ft., and its cruising rating is 900 hp. at 1,600 rpm.

(Lower left) Side view of Russian 12-cylinder aircraft Diesel showing 2-stage turbo-supercharging for each 6-cylinder bank. (Lower right) Rear view of same engine showing 2 intake manifolds and 2 fuel injection pumps in tandem.





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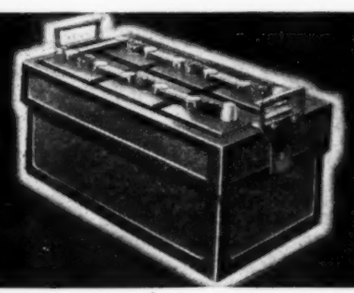

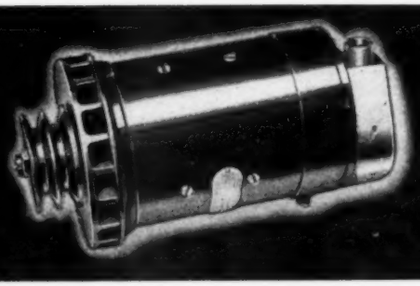

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SUPERVISING & OPERATING ENGINEERS' SECTION

Conducted by R. L. GREGORY*

"UNIT INSTALLATION AND ITS EFFECT ON DAILY OPERATING PROBLEMS"

IN the field of Diesel operation, there are many supervisors and operators alike, who are not aware of the fact, that installation details play a very important part in the daily operation of their units. That is, that the planning and erecting of a unit, and the details involved may have direct results on daily operation.

Therefore this department will endeavor to present, in a series of discussions, these various points, taken from the installation of a modern 3600 bhp., crosshead type unit, two cycle, solid injection, with a separate scavenging blower, motor driven. This type of unit is becoming quite popular with many municipal and industrial plants today. In this series of articles, the author will endeavor to give a comprehensive and complete coverage of design and arrangement, which will show some of the effects on daily operation.

Many operators do not feel that installation work and the problems involved are of any importance to them in their daily operating tasks. They do not realize that a thorough knowledge of the unit from the time the foundation is started until the complete unit is assembled might be of great help in their daily operating problems. Having the "know how and why" of a unit in mind, should improve their operating technique, especially when emergencies arise.

The operator with this knowledge of where to find causes of difficulties, how to overcome them, how and when to make adjustments, and the confidence he acquires by having that knowledge, may often save time, interruptions, money and materials by being able to do the right thing at the right time.

Before going into the details of the installation proper, let us look at some of the preliminary problems involved in acquiring the unit. When conditions arise which call for plant expansion, a reputable engineering firm is generally hired to make a plant survey, to determine just what equipment is needed. This firm generally considers, present available plant equipment, load demand and conditions and tries to estimate what conditions will be several years in the future. From this survey, they are able to determine, the size and nature of the proposed new equipment, and from this survey they are able to make their recommendations.

After these recommendations are made, a set of preliminary plans and specifications are drawn up. In drawing up such specifications, one thing is of vital import and that is to ascertain that the new unit and its characteristics will dovetail in with present equipment, not only from the generating standpoint, but also from the mechanical and operating standpoint. The proper placing of auxiliaries, pipe lines such as water and fuel lines, tanks, heating apparatus, and all such materials must be thoroughly gone over, since errors in location of such equipment, may not only add to installation costs, but may affect not only the individual unit operation, but revert back onto operating conditions of units already installed.

When these preliminary plans and specifications are drawn up, copies of the same are usually furnished to prospective bidders in order that they may check them over and ascertain whether they can furnish a unit to meet said specifications. After all bids are in and the vendor is finally selected, the real work of installation and preparation for same begins. The engineering firm then collaborates with the engineering department of the vendor, and together they work out all the details of installation and revise their prints so that they become workable to that particular plant.

In working up the proper installation plans, item after item must be checked and rechecked, in order to ascertain its proper location to give the most efficient results, both as to installation costs and operating conditions. Another important feature which should be taken into consideration in locating auxiliaries and equipment outside of the main unit, is the point of accessibility as affects the maintenance of the unit and those auxiliaries. Too often this point is not given proper consideration, and while the original installation may from all appearances look ideal, when something goes wrong and the maintenance crew are called in, they find difficulties and realize that had more thought been given to the location and design of the part in question, their task of repairing the same auxiliary or part, would have been much easier.

Many of us have been in plants and found equipment crowded together with no thought given to the maintenance end, such as several pipes running together over a heat exchanger head, which piping would have to be removed before the tube bundle could be removed. That is just one incident that the writer noticed in a rather recent installation. When the maintenance crew had to pull a tube bundle, they had to remove several water lines, which could easily have been piped up to one side and given them head clearance. Just a little oversight on the layout, but very inconvenient as far as maintenance was concerned.

Another item of importance in such a layout, and one in which the operator should be interested, is the location of valves, strainers and parts of the equipment which he uses several times during a shift. These should be placed in easily accessible places so that in cases of emergency, he can get at them without trouble. Valves placed high off the floor or behind equipment, are poor locations for operation.

In designing an engine layout, there are always some auxiliary items which should be duplicated in so far as possible. Such items as cooling water pumps, soft water circulating pumps, fuel pumps, transfer pumps, etc. While the original cost of such duplication may seem excessive, still it is good insurance against interruptions and breakdowns causing outages.

Beginning with the next issue the subject of the foundation will be taken up, and photographs showing the various stages of the foundation construction will be presented.

* *Chief Engineer, Municipal Water and Light Plant, Hillsdale, Michigan.*

THE PRIMARY purpose in the design of an isolation mounting is to establish a natural frequency in the machine on its mountings which is very slow in comparison to the frequency of the disturbance. This condition can be established by the use of a number of resilient materials such as cork, rubber, or coil springs. If the required static deflection of the isolator is obtained the selection of the isolation material is entirely a matter of personal choice. They will all give equal efficiency.

This condition is true if we ignore damping. Of the three, only coil springs have a negligible damping factor and damping decreases the efficiency of the isolator. If properly used, however, this damping can become a most beneficial force. Its detrimental effects can be readily offset by making the isolator just a little softer and then when the engine passes through a critical, as it always must, where the isolator is in resonance with the disturbing force, some damping is absolutely essential for continued smooth operation.

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Exchange Your Diesel Maintenance Ideas

Conducted by R. L. GREGORY

Editor's Note: In this department we provide a meeting place where Diesel and Gas engine operators may exchange mutually helpful maintenance experiences to keep our engines in top condition. Mr. Gregory edits your material and adds constructive suggestions from his own wide experience. This is your department—mail your contributions direct to DIESEL PROGRESS.

"Engine Maintenance" Part 2.

CONTINUING our discussion of the above subject, let us take up the importance of checking over engine alignment. This is of vital import whenever a major overhaul job is to be done. This is of particular importance in the matter of large heavy-duty units which are subjected to long periods of operation under heavy load strains.

At the time of erection, this point is given main consideration since the operation of the unit depends a great deal on the matter of correct alignment and assembly. However the possibility is ever present, that conditions under which the unit was first erected may change from time to time. Constant operation of the unit has been known to cause settling of the foundation, loosening of anchor and parting bolts, etc. This occurrence is an exception of the general rule, since most large units are placed on foundations which carry an ample factor of safety. However it is not a bad policy to check this alignment.

If in carrying out such a check, one finds that the foundation bolts or parting bolts in the various joints are loose, any tightening of the same should be carefully watched as to results on the general alignment, and tightening of these loose bolts or nuts should not be done haphazardly without a recheck of alignment.

The tolerances of both main and crank bearings should always be taken in a major overhaul, as well as the tolerances between wrist or crank pins and rod bushings. In a well operated and maintained unit, properly lubricated with good lubricant, bearing wear is a slow process. However it is an impossibility to state just what the life of any bearing should be since this wear and tear varies in all plants, due to operating loads, conditions, lubricants used and many other causes.

In taking these tolerances, those in charge of such a major overhaul should keep a complete record of their findings from year to year. This of course is for the purpose of comparison. Since there is a point of maximum tolerances allowable for bearing wear, such a record, is of more than vital importance in determining when this maximum point is reached and when replacement parts are needed. In operation of a unit, it has been found, that the greater these tolerances beyond a certain point, the faster these bearings will wear and should these clearances become too great, bearings, especially babbitt bearings, will deteriorate much faster.

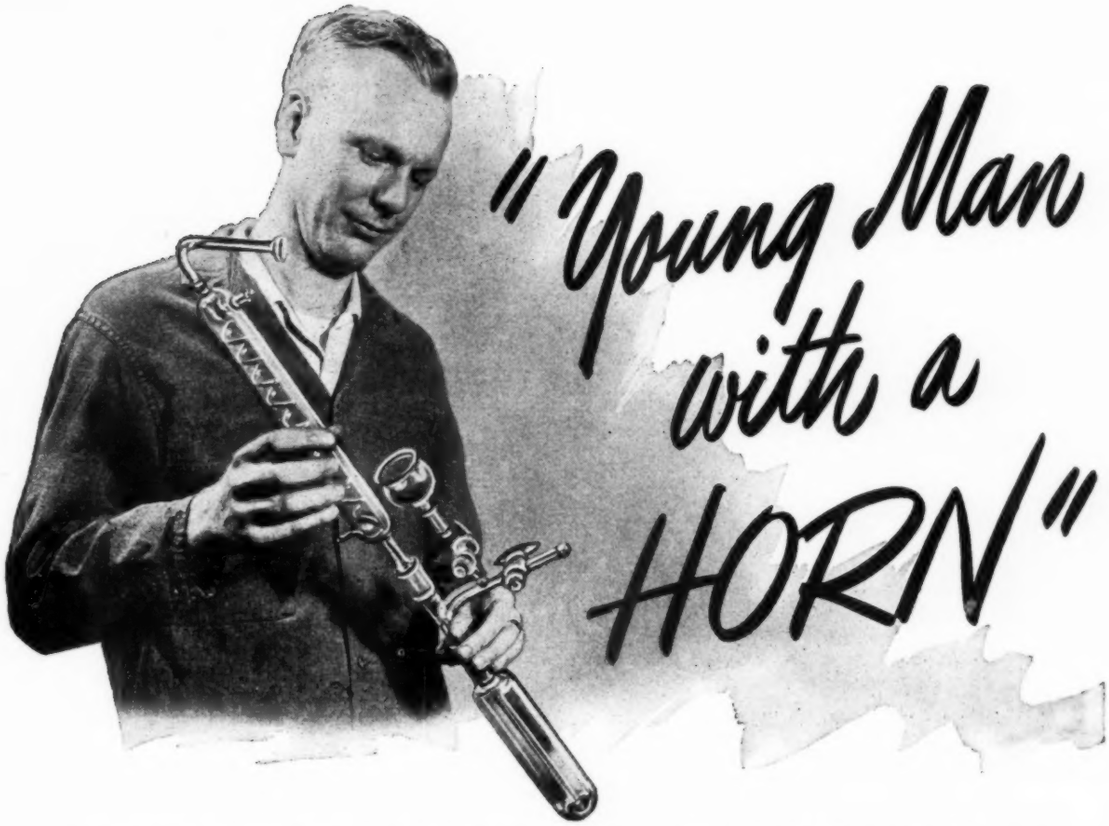
The main bearings are most important of all, since misalignment of main bearings is nearly always the cause for crank breakage. In checking crank alignment it is good policy to check all webs on the four quarters, and note the results from year to year. Such a check will usually give a pretty clear picture of what is happening to your unit and forms a basis for determining the procedure you should follow.

It is a matter of course, that connecting rod bearings and crank or wrist pin bearings will have to be replaced from time to time, since these bearings and points take the bulk of the strain and stress of operation. No definite period can be given as to the longevity of these bearings, since operating conditions vary from year to year, and while one bearing may outwear its neighbor, or one unit may operate for years without any appreciable wear, its neighbor may have to have more frequent changes.

The matter of lubrication has a lot to do with bearing wear. One cannot be too particular about the condition of the crankcase lubricant, nor the manner in which this lubricant is handled and filtered. Of course continuous filtration of the crankcase lubricant is a most desirable setup, especially on large units. With such a filtering system, the lubricant is constantly passing through the filtering agent, which removes moisture and foreign particles which are detrimental to the lubricant. Therefore it is usually good practice to thoroughly clean the crankcase and side wall of a unit after a major overhaul, to make sure that the lubricant is in first class shape.

Most plants have equipment to prevent dirt and foreign particles from dropping in the crankcase, when work is being carried on above it. Such work as cleaning out cylinder ports, or grinding off shoulders on liner walls. But even with such equipment, many small particles are bound to get down into the crankcase, hence the necessity of thoroughly cleaning up before starting a unit after a major overhaul. In our plant, when beginning a major overhaul, we usually drain the crankcase completely before starting the job. Then we have provisions for covering the crosshead guides, crosshead and crank bearings. After the ports and liner wall are cleaned, we usually take a tank of light fuel oil or kereosene and spray the side walls of the crankcase and wash them down into the crankcase. The whole is then thoroughly wiped up, the crankcase cleaned and wiped perfectly dry with large rags (no waste or small rags used) along with the oil sump. The filtering agent is removed from our continuous filter, after draining the filter and replaced with a new cartridge. Before replacing the cartridge all connecting piping between the filter and engine is drained, and the filter washed and wiped out. Then the whole is reassembled and a complete batch of new filtered oil placed in the crankcase.

This is no condemnation of batch filtering. That too can be successfully carried out if done on a regular schedule. Before equipping our units with the continual filtration system, we used the batch system, draining the oil from the crankcase religiously every month, cleaning it up and replacing the old oil with clean filtered oil. However this is a more laborious job and one that requires constant vigilance if the best results are desired. We still use the batch filtration to clean up the dirty oil removed from the crankcase but we have found that instead of filtering oil every month in order to have a clean supply, our continuous filtration requires filtering oil in the batch filter only about three times a year and that we use less agent on the oil that has been in continuous filtration than we did previously. Another advantage of continuous filtration is that both side walls of the crankcase as well as the crankcase proper are much cleaner, when inspection doors are removed for inspection.



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Gas Turbine

. . . . *Continued from page 43* . . . .

long. This was the largest forging ever made of this material at the time and a number were rejected before a sound forging was secured.

The cylinder is made of stabilized 19-9 stainless steel into which are cut grooves for holding the stationary blading. The design was made as nearly symmetrical as possible. The horizontal flanges have been eliminated and the vertical flanges on the inlet end have been slotted to minimize the effect of thermal distortion on the cylinder walls due to rapid temperature change.

All bolting is made of Westinghouse K-42-B material. For the horizontal bolting, sleeves are used to eliminate the need of a flange and to increase effective bolt length. The bolting problem is difficult since the gas turbine must operate over wide temperature ranges and must be capable of taking instantaneous changes of from 700°F. to 1350°F. in going from no load to full load. The design used has proved entirely satisfactory to date. The turbine is positioned with suitable mechanical hinges arranged to allow for rapid thermal changes while still maintaining proper alignment with the rest of the machinery.

A diffuser and elbow are used to recover a part of the leaving velocity energy and to turn the gases with a minimum of energy loss. At full load the exhaust velocity from the turbine is approximately 500 feet per second and a substantial portion of this energy is recovered by the diffuser.

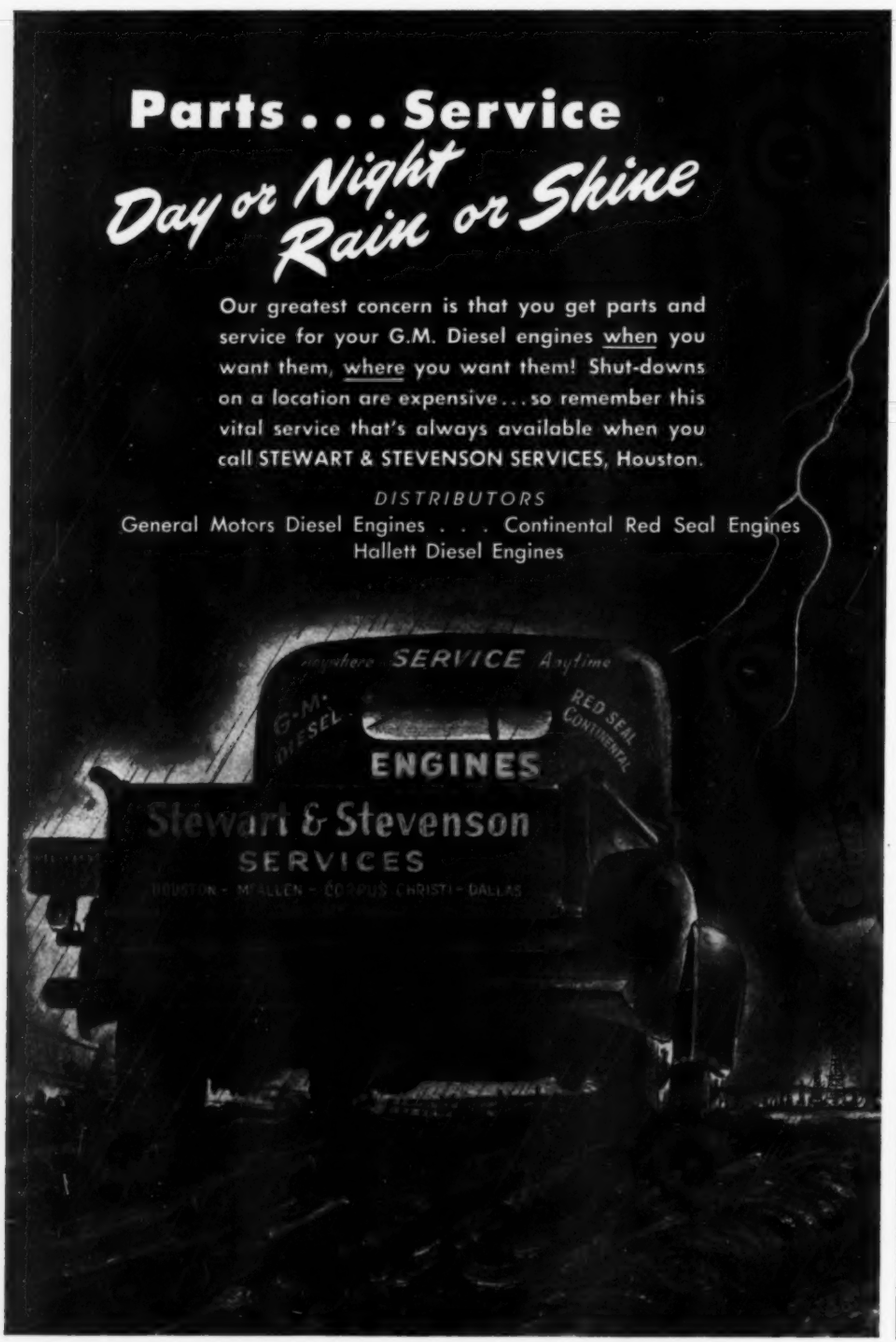
The gear is a single reduction double helical type. Of particular interest is the pinion which is made of an alloy steel and has twenty hobbed, flame hardened and ground teeth. This type of gearing is similar to that employed on the Pennsylvania Railroad geared turbine locomotive which has proved successful in actual road service. The experience gained from this gear design points the way to designs carrying twice the load without any appreciable change in weight or size. The gear has pressure lubricated sleeve type bearings throughout.

Mounted on the reduction gear is a one-half horsepower turning gear motor which drives through a worm and wheel to a spur pinion which in turn drives the gear on the main pinion shaft. This keeps the set turning to avoid thermal distortion of the rotating parts at shut-down and enables quick starting at any time.

A double-armature d-c generator, operating at 1200 rpm. absorbs the useful power. The d-c type generator provides a loading device with a very wide operating range. This offers an excellent means of testing the set and developing the proper controls.

To reduce noise, silencers were installed on both the inlet and exhaust. The inlet silencer was designed with twelve openings, 7¾ inches by 9 inches by 40 inches long, while the exhaust silencer has sixteen such openings. Both were lined with sound absorbing fire brick.

In the test setup two water rheostats are used to absorb the power output of the d-c generator. Suitable instrumentation has been provided to measure accurately, the overall performance as well as that of the component parts. Motor-driven, geared-type lubricating and fuel-oils pumps are used. Diaphragm type control valves are used in the fuel system and are arranged to provide flexibility in testing fuel controls.



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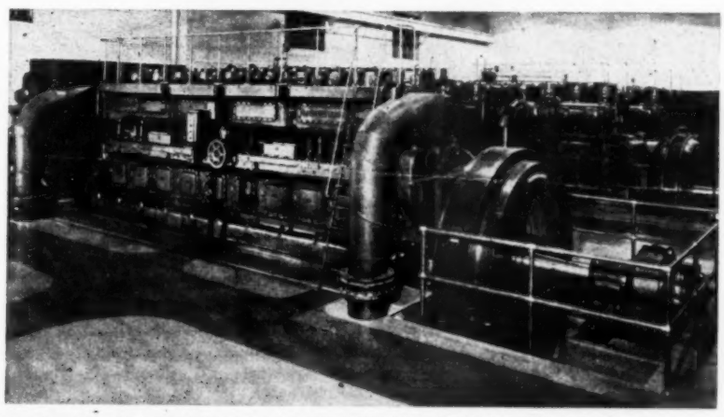

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1- 350	General Motors	250	1200	85%
2- 270	Hercules	125	1800	100%
2- 240	Fairbanks YVA	200	257	75%
1- 180	Fairbanks YVA	150	257	90%
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See Special Offering Page 28

EMERGENCY POWER SUPPLIED BY HOSPITAL DIESEL

By FRED M. BURT

This Worthington Diesel, regularly supplying power for Hospital, did yeoman service for community isolated by forest fires.

WHEN brush fires of major proportions swept through San Diego County, California not too long ago, district residents received emergency light and power from Mitchell Convalescent Hospital's Camp Lockett power plant, situated in the Laguna Mountains, sixty miles from San Diego.

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The district plant was not sufficient to carry the load for the hospital when the camp was built, so the post built its own plant. The three Diesels, originally shipped to U. S. Ordnance for installation as Narragansett 16 in. gun mount, Newport, Rhode Island, were later transferred by the Army to Mitchell Hospital's power plant.

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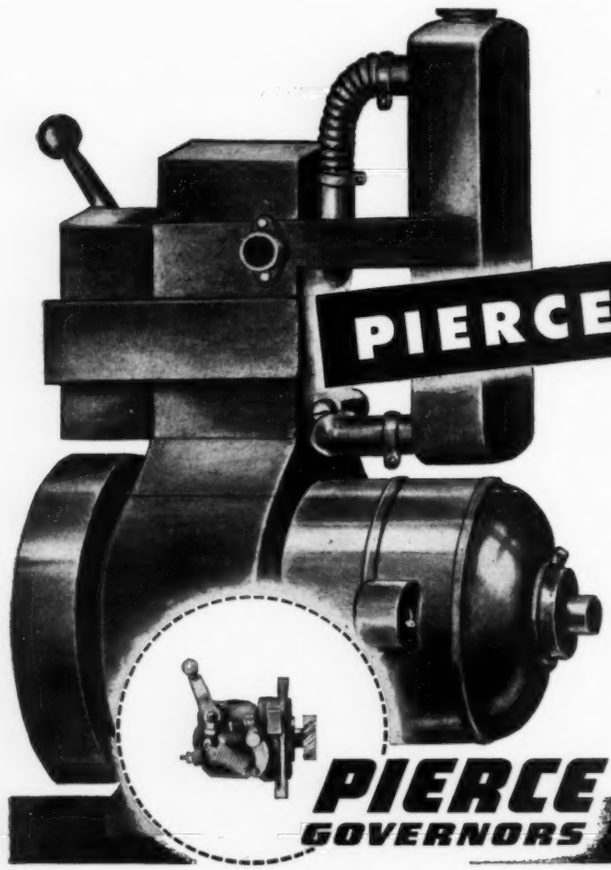

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Horsepower from the Indicator

. . . . *Continued from page 47* . . . .

corresponds to the work performed by the piston.

In offset and time diagrams the abscissa is not proportional to the piston travel and the diagram area will not correspond to the work performed by the piston. Any time or offset diagram may, however, be converted into an in-phase p-v diagram which can then be planimetered in the described manner.

Opposed Piston Engine Indicator Cards

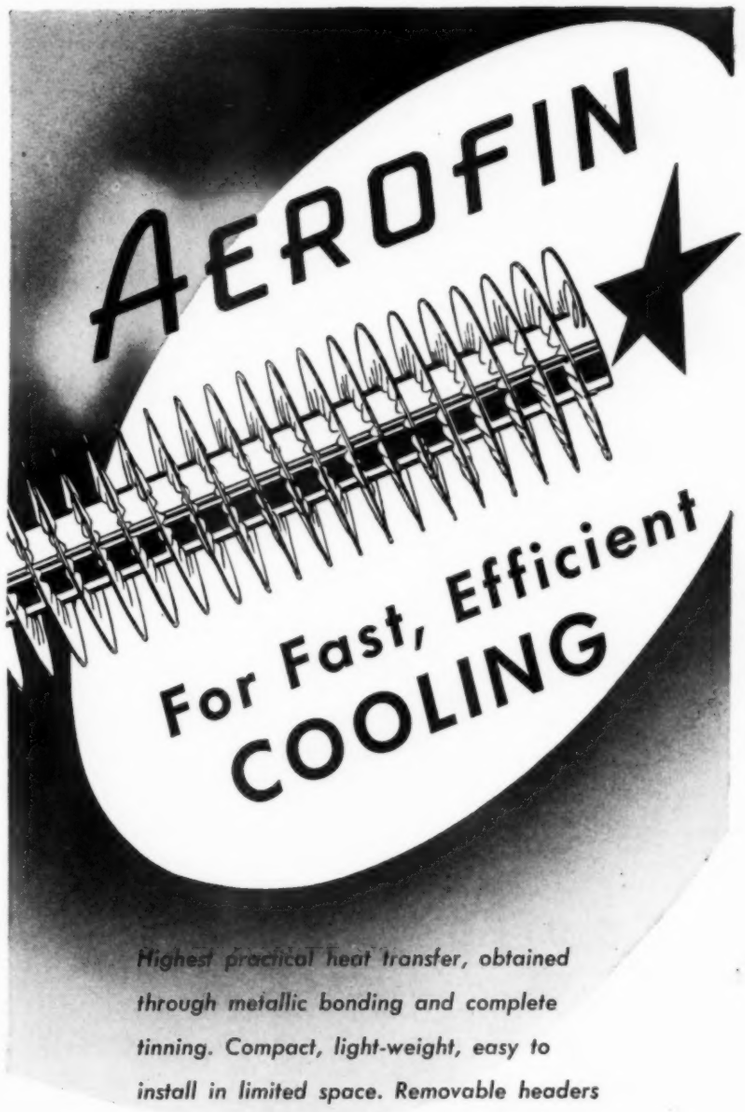
In opposed piston engines it is customary to give the exhaust piston a lead of 10 to 15 degrees out of phase with each other. When an indicator diagram is taken, the question is which crank to use. Ordinarily both cranks are used and two sets of cards are obtained, referred to as exhaust crank and inlet crank indicator diagrams. Time diagrams scribed on crank-angle basis will not differ in shape, only one will be horizontally translated relative to the other.

However, when pressure-stroke diagrams are taken the two cards will have strikingly different appearances. The exhaust crank diagram will be unusually flat and the inlet crank diagram unusually thin. The exhaust crank diagram may have an area more than twice the inlet crank diagram area. From this it is frequently inferred that the load on the inlet piston is relatively small while the exhaust piston has to stand the major portion of the burden.

The truth of the matter is that the opposed piston engine cylinder has only one combustion space and only one pressure-volume diagram instead of two. Confusion arises from the habit of failing to discriminate between *pressure-volume* and *pressure-stroke* diagrams. For a single-piston engine that is of no consequence because the instantaneous cylinder volume is proportional to the piston travel. For the opposed piston engine this is no longer true and we must discriminate between the pressure-volume and pressure-stroke diagrams. The pressure-volume diagram is the same because there is always only one volume between the two pistons, but the pressure-stroke diagrams are vastly different.

In Fig. 4 the time or crank angle diagram of an opposed piston is shown and is marked A. The corresponding pressure-stroke diagram is also shown. In the time diagram the time is

. . . . *And now please turn to page 74* . . . .



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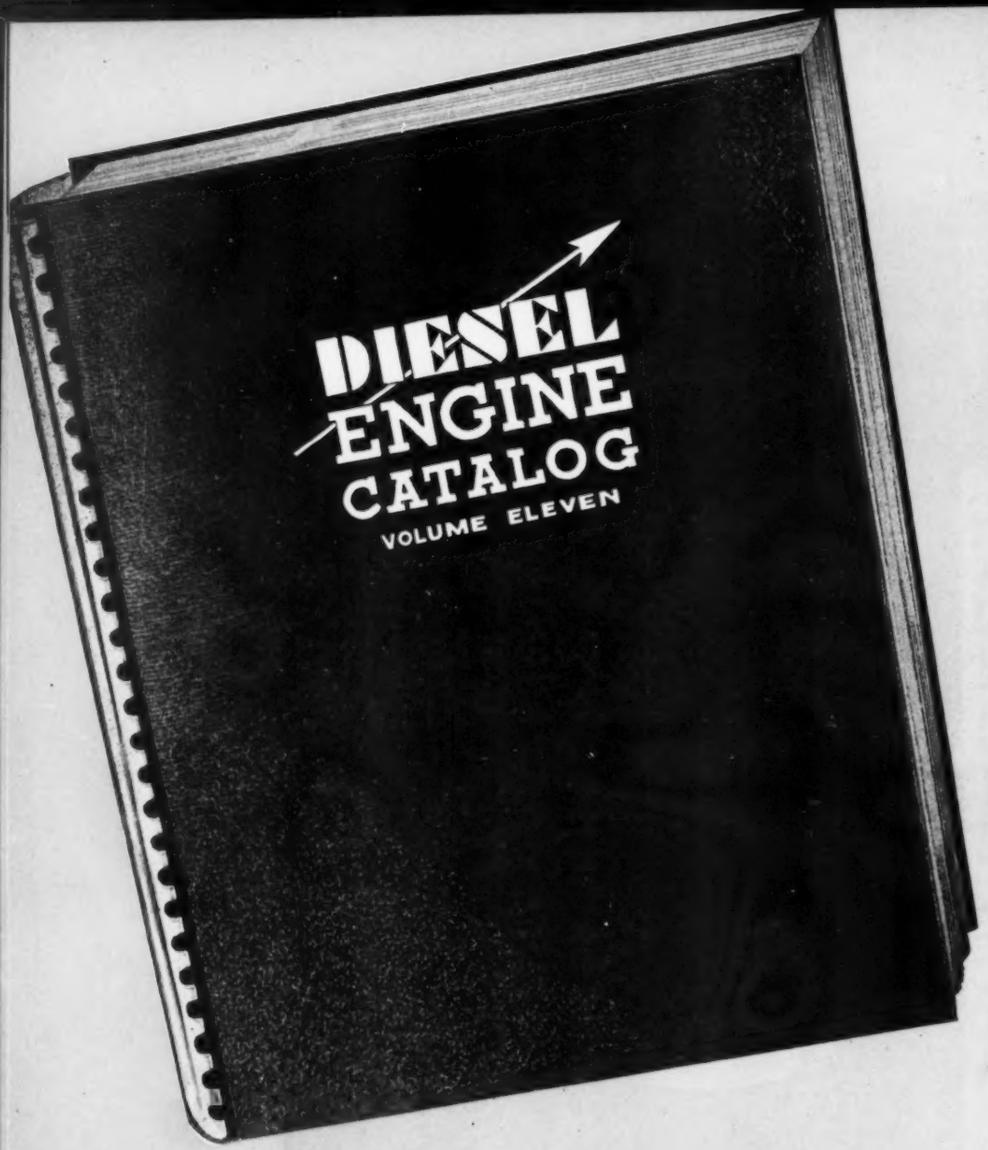

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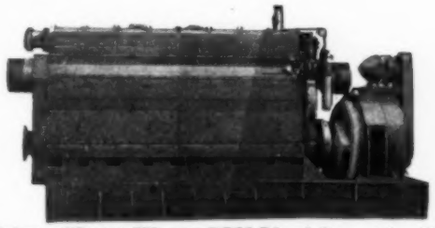

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. . . . *Continued from page 71* . . . .

counted from minimum volume to minimum volume. Referred to the crank angle of the exhaust piston and the intake piston the crank angle diagrams will be 7-1/7 degrees advanced (B) and retarded (C) relative to diagram A. In converting the crank angle diagrams into pressure-stroke diagrams by the known graphical methods, we get from B the vertically shaded thin diagram and from C the horizontally shaded diagram. The mep-s obtained by planimetration are 96.8 psi. for A, 62.5 psi. for B and 142.5 psi. for C. According to this the power transmitted by the exhaust piston is more than double of the power transmitted by the intake piston. It would be, however, incorrect to conclude that the exhaust piston is carrying an undue burden while the intake piston is loafing. Actually, except for the scavenging gas flow, both pistons are exposed to exactly the same pressures and temperatures for the same lengths of time. For horsepower calculations the pressure-stroke diagrams may be used, but for most other calculations only the time p-v diagram is relevant while the pressure-stroke diagrams only create wrong notions.

Oil Purification, Filtration and Reclamation

. . . . *Continued from page 61* . . . .

quired. Also, experimentation is generally required to determine suitable operating conditions for the treatments.

Treatment with Alkaline or Caustic Solutions

Generally the oil is heated to about 150° F. and mixed thoroughly with 10% alkaline solution for a considerable period of time in order to get satisfactory contact. Following this, the mixture is allowed to settle and the caustic solution and solids are drawn off at the tank bottom. The oil is then washed with water until the water appears clear when it is drawn off. To insure thorough washing, the wash water should be tested with an indicator and washing continued until the water drawn off is essentially neutral. Following the washing the oil is either filtered or centrifuged to remove the last traces of water. Sometimes it is necessary to filter the oil through adsorbent clay or to redistill the oil to remove organic soaps which are oil soluble. Partial or complete distillation is necessary if products of dilution are to be removed.

Treatment with Acid Followed by Caustic or Clay Neutralization

The oil is allowed to rest in a storage tank to promote settling of insoluble matter. The settled oil is then mixed with acid (dilute sulfuric acid normally about 10%) at a suitable temperature and the acid sludge is settled and drawn off. Further treatment is necessary to remove the last traces of acidic components. If these materials are inorganic in nature, clay treatment alone will generally remove them. If organic acids are present in appreciable amounts, it may be necessary to caustic wash the oil to convert them into soaps, which can be removed by subsequent clay filtration. After clay treatment, some method of separating the clay from the oil, such as filtering, must be employed.

Using this procedure oil may be treated with acid in a single or in several steps. Multiple step treatment is preferred because temperatures are more easily controlled and any water present in the oil is removed by the first batch of acid and thus does not dilute the subsequent acid batches thereby impairing their reclaiming powers. When multiple step treatment is used, the sludge is drawn off before each acid addition.

Some of the disadvantages to reclaiming used oils through chemical treatment are:

1. Treatment has to be carried out by personnel well acquainted with the subject under the supervision of qualified technicians.
2. Experimentation is necessary to determine the proper concentration of acid and temperature of operation to give best results.
3. Emulsion troubles may be encountered, especially with heavy oils, highly oxidized oils, or those containing additives.
4. Treatment losses are usually high.
5. Process is uneconomical unless carried out on large volumes of oil.
6. Additives are removed from heavy-duty oils.

Chemical treatment of used lubricating oil is perhaps the best method for reclaiming when proper equipment and suitable personnel are available.

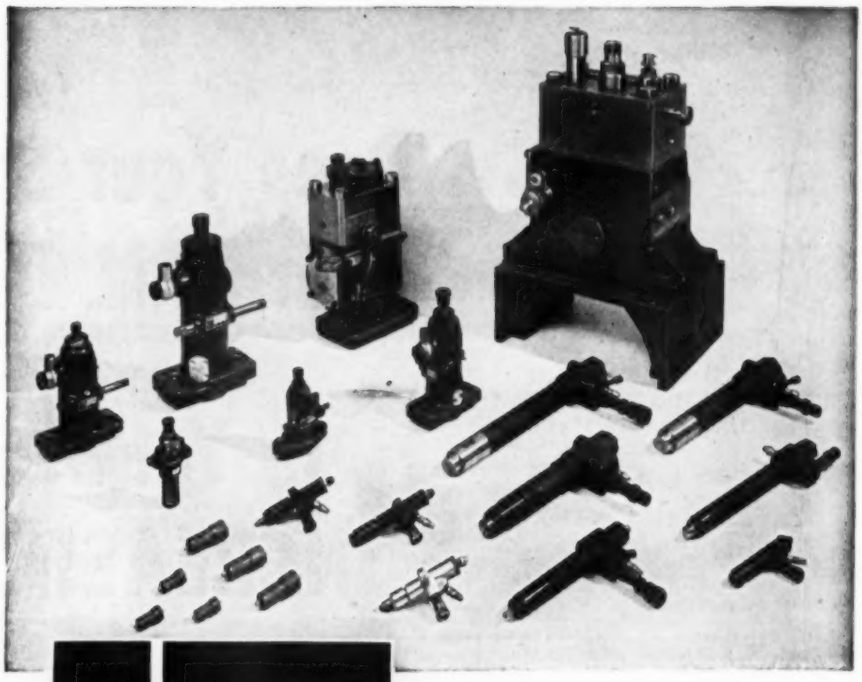
Conclusion

A most important consideration, and one which must not be overlooked when selecting a method for extending the useful life of an oil, is that the oil after purification, filtration or reclamation must still be able to satisfactorily perform the function for which the new oil was designed and recommended. A close check by laboratory inspection, or established routine of operation, should therefore be maintained, once it has been established that a selected method of procedure will give satisfactory performance.

Nalco Bulletin Describes Cooling Water Treatment For Diesels

A NEW bulletin published by the National Aluminate Corporation describes Nalco No. 37, a product designed for the prevention of scale in the cooling systems of Diesel engines. The action of Nalco is to form a self-repairing protective film over all wetted surfaces in the water jacket thus protecting the base metal from corrosion and the formation of scale. Furthermore, this agent is claimed to inhibit electrolytic corrosion. The bulletin cites the experience of an eastern railroad with Nalco 37 which found that the product aided greatly in the prevention of scale. Nalco 37 is used at the rate of .4 ounce per gallon of water and this ratio should be maintained. It is recommended that the cooling system be drained and flushed every 3 months.

The National Aluminate Corporation maintains a field service which is available to interested persons. For further information write the National Aluminate Corporation, 6216 West 66th Place, Chicago 30, Illinois.



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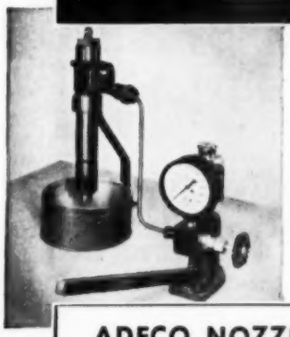

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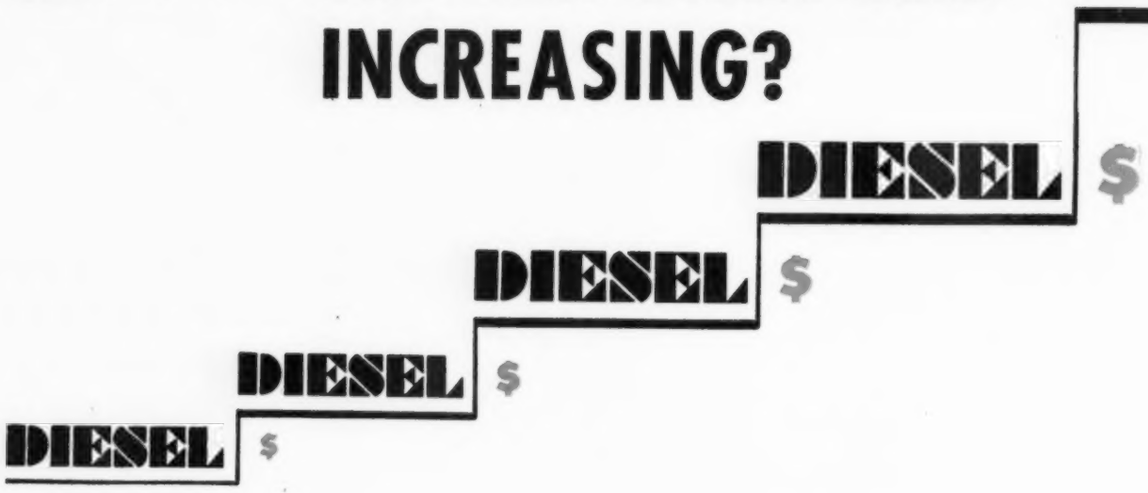

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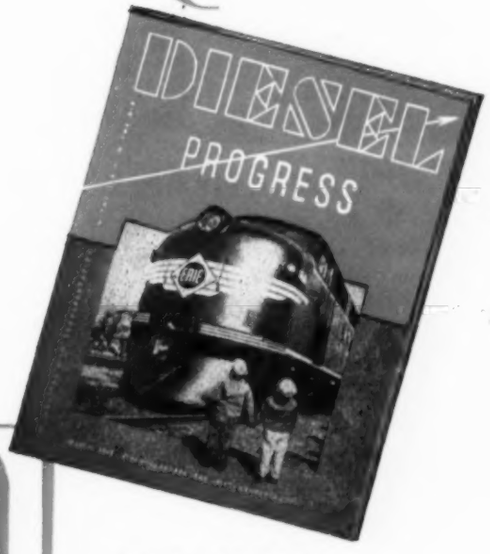
You reach more *buyers* through DIESEL PROGRESS because its readers include more executives. The men with the power to buy are intensely interested in its factual, timely editorial articles and depend upon DIESEL PROGRESS for authoritative news of the entire industry. Its proven readership is earned by a progressive editorial policy, devoted exclusively to the advancement of the Diesel Industry.

If you manufacture a Diesel product and want a bigger share in the mighty Diesel market, your best advertising buy is DIESEL PROGRESS. No other Diesel medium can equal its concentrated circulation and high readership. Plan *today* to increase your present sales through DIESEL PROGRESS.



PROGRESS

Edited and Published by

REX W. WADMAN

Affiliated publications, under the management of Rex W. Wadman: Diesel Engine Catalog ★ World Petroleum ★ Petroleum World ★ Petroleo Del Mundo ★ El Mundo Azucarero ★ Sugar ★ Sugar Reference Book ★ El Catalogo Azucarero

Program Announced For 19th Annual Oil and Gas Power Conference at Cleveland

COMPLETION of final plans for its 19th Annual Conference, to be held in the Statler Hotel, Cleveland, Ohio, May 21-24 inclusive, has been annouced by the Executive Committee of the Oil and Gas Power Division of the A.S.M.E., of which Lee Schneitter is Chairman. In addition to the customary technical sessions, manufacturers' exhibits, plant inspection trips and social events, the Division will sponsor, as a special feature, an entirely new idea in Technical Education for practicing engineers. In brief, this will consist of a series of three specially-arranged lectures to be given by recognized authorities, each an expert in his field. The general theme is the subject "Diesel Fuels." Titles of the lectures in the order of presentation are: Production of Diesel Fuel Oils; Physical and Chemical Characteristics of Diesel Fuel Oils; and Combustion of Diesel Fuel Oils.

A fee will be charged for the lecture series. To assure maximum service to those interested, the size of the audience will be restricted. Hence, it is suggested that registrations be arranged promptly by writing to W. L. H. Doyle, Caterpillar Tractor Company, Peoria, Ill., for full details and registration card.

Highlights of the agenda for the Conference proper are summarized here:

WEDNESDAY, MAY 21
A.M.—Registration
P.M.—Technical Session—3 papers
"Suggestions on Use of Internal-Combustion Engines in Locomotives"
"Some Aspects of Fuel Injection for Aircraft Engines"
"Test Results of Internally-Cooled Supercharging"
THURSDAY, MAY 22
A.M.—Technical Session—2 papers
"Diesel Fuel Oil Supply Situation"
"Comparison of Various Vegetable Oils as Fuels for Compression-Ignition Engines"
P.M.—Plant Inspection Trips
FRIDAY, MAY 23
A.M.—Technical Session—2 papers
"Sleeve Bearing Design Fundamentals for Diesel Applications"
"Large Bearing Design, Application and Operation"
P.M.—Plant Inspection Trips
SATURDAY, MAY 24
A.M.—Technical Session—2 papers
"Diesel Engine Bearings"
"Behaviorisms of Aluminum Alloy Bearings in Diesel Engines"

Inspection trips—which will be made to plants of Cleveland Diesel Division of General Motors, Cleveland Graphite Bronze, Aluminum Company of America and N.A.C.A.—are to be so scheduled that interested engineers can visit all four plants during the two afternoons.

Social events include a luncheon on opening day, Wednesday, May 21; a buffet supper and a social hour Wednesday evening; an Exhibitors' social hour Thursday noon; and the banquet, on Thursday evening, at which George Codrington, Vice President of General Motors, and Honorary Chairman, will preside.

Manufacturers of Diesel engines and accessory equipment have already reserved much of the available booth space, and a diversified, instructive group of exhibits is assured.

Those planning to attend the Special Lectures are advised to make hotel reservations soon.

PROVED IN THE FIELD

MICHIANA FILTERS

MICHIANA Filters have been rigidly tested and proved on all types of essential equipment including marine craft and military motorized units; in stationary plants—on trucks, farm and construction machinery—on streamliners, freight and switcher locomotives. Performance checks demonstrate that they more than meet all practical field conditions for efficient filtering, durability, and servicing economy.

Engines stay clean for many extra miles of lower cost operation when MICHIANA Filters are installed. Engine life is lengthened, oil consumption cut, and maintenance costs are reduced. You will find a MICHIANA Filter of the correct size and type for any engine, gas or Diesel—up to several thousand horsepower. Use the oil filter built on experience—MICHIANA.

Bulletins 839 and 45-D describe filters for gasoline and Diesel engines respectively—Send for copies today.

MICHIANA OIL FILTERS

MICHIANA PRODUCTS CORPORATION
Michigan City, Indiana

Straube Named Assistant Sales Manager for Superior

R. C. Straube

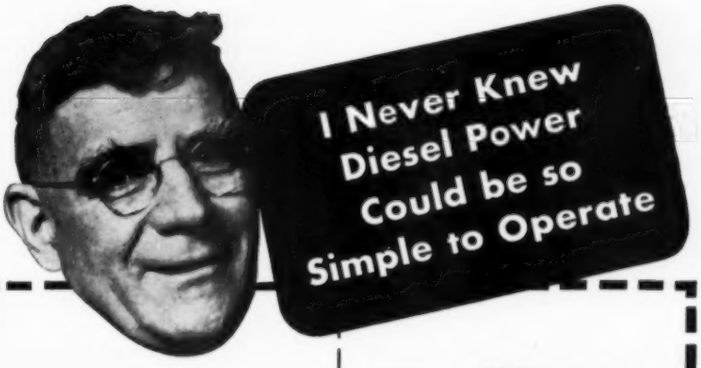
R. C. STRAUBE, who has been Regional Manager for Ohio, Michigan and Indiana for the Superior Engine Division of The National Supply Company, has been promoted to assistant to Robert M. Pearson, Manager of Sales of the Division. Mr. Straube has had many years of experience in engineering and sales work in the Diesel engine field. He joined Superior in 1935. He is well known in the Diesel industry and has served on the Standard Practice Committee of the Diesel Engine Manufacturers Association.

Socony-Vac Announces Two New Appointments

HERBERT WILLETTS, manager of the Central Marketing Region of the Socony-Vacuum Oil Company, Inc., has been appointed to the newly-created position of national marketing manager.

Mr. Willetts has been with Socony-Vacuum since he was graduated from Union College in 1923. He started as a clerk in the tank and pump department and rose through various positions in the marketing department. H. T. Ashton, currently manager of Socony-Vacuum's Lubrite Division with headquarters in St. Louis, will be in charge of all the marketing operations of the company in the sixteen mid-western states comprising the company's central marketing region. His headquarters will be in the Central West.

IF YOU HAVEN'T ORDERED YOUR COPY OF THE LATEST DIESEL ENGINE CATALOG, VOL. 11, BETTER DO IT TODAY, SEE Page 72.



MY SHEPPARD *is a full diesel ... has no distributor, coil or spark-plugs that need attention and care. Rain won't stop it.*

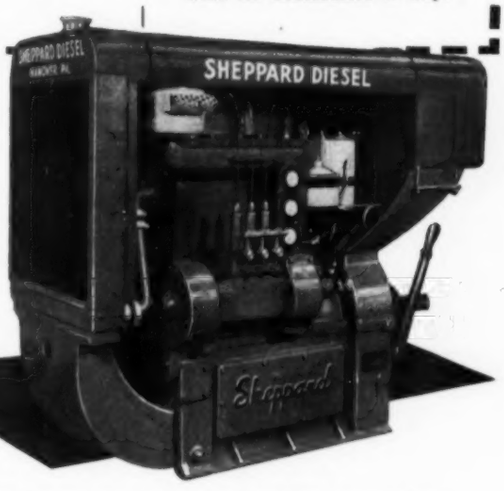
THE SHEPPARD *Diesel operates and starts on common furnace oil, injected in a solid spray. There is no temperamental carburetor to adjust and maintain.*

I SET *the throttle ... push a button ... and my Sheppard is running. Dependable power ... free from all outside interference is at my fingertips.*

MY SHEPPARD *Diesel was delivered complete. I just put it in place, supplied it with fuel, lubricating oil and water and it was ready to work. There were no accessories to buy.*

Write for the illustrated booklet that completely explains many other outstanding advantages of Sheppard Diesel power units and generating sets.

R. H. SHEPPARD CO., INC.
16 Middle St., Hanover, Pa.



Sheppard DIESEL

Generating Sets—2,000 to 36,000 Watts • Power Units—3¼ to 56 continuous H.P.

DIESEL'S THE POWER . . .

Sheppards the Diesel

National Marine Exposition Draws Top Marine Leaders To San Francisco

THE "Magnet" that is drawing many of the nation's top marine executives to the West Coast, is the opening May 12th, of the Second Annual National Marine Exposition, sponsored by the Propeller Club of the United States, in San Francisco's Civic Auditorium. For the first time in the annals of the industry's long and brilliant history, a national marine exposition, with all of the fanfare of its New York Premiere in 1946, is being brought to the West Coast.

Practically every field in the marine industry will be represented. Some of the outstanding exhibits of the New York Show will be shipped West in order to present to the audience on the Pacific Coast the same costly displays that were accorded so much favorable publicity in New York City. Notable among these will be the exhibits by: Sperry Gyroscope Company, Inc., Radiomarine Corporation of America, Johns-Manville Corporation, Mackey Radio & Telegraph Company, Worthington Pump & Machinery Corporation, Cargocaire Engineering Corporation, The Texas Company, George C. Sharp, Submarine Signal Company, Alcoa Steamship Company, Inc., and American Export Lines, Inc.

Some of the unique features of the various exhibits are "top secret" until Opening Day, according to Roger E. Montgomery, President and General Manager of the Exposition, under whose guidance the National Marine Exposition has gained the title, "National Market Place of the Marine Industry."

This year in San Francisco, the National Marine Exposition extends a most hearty welcome to a new and very important group of exhibitors, the Diesel Engine Manufacturers. For the most part, this May's Opening Day will find them on hand as prominent participants in this annual event, for the first time. The Diesel group will include among others, Atlas Imperial Diesel Engine Company, Cummins Engine Company, Enterprise Engine & Foundry Company, Lorimer Diesel Engine Company, Nordberg Manufacturing Company and Worthington Pump & Machinery Corporation.

Special Educational Exhibits will play a big part in acquainting the general public to the importance of the American Merchant Marine and other Maritime Services. These will include the United States Navy, U.S.M.S. Officers Schools, United States Coast & Geodetic Survey.

NAVIGATORS know that a compass is DEPENDABLE for guidance. North is *always* NORTH.

Buckeye Diesels give their owners that kind of dependability, too. The name "Buckeye" on an engine has been the symbol of DEPENDABLE POWER ever since 1908 — always a proved guide to DIESEL ECONOMY.

Every feature of Buckeye design and construction has been developed to bring greater dependability and economy to users of Diesel power. For example: No bolts, studs, cap screws or gaskets are used to secure the exhaust and air manifolds to the cylinder heads. This is an exclusive Buckeye feature which, by making cylinder heads easily removable, eliminates valve cages. As a result, valve areas are larger and combustion efficiency is increased by providing unrestricted air flow and quicker expulsion of gases.

Stationary Engines 150-1440 H.P.
Diesel Generator Sets 100-1000 KW.

WRITE TODAY for your Buckeye bulletins. Place your order NOW for early delivery.

THE BUCKEYE MACHINE COMPANY · LIMA, OHIO
· ENGINE BUILDERS SINCE 1908 ·

Worthington Board Elects S. R. Williams

THE Board of Directors of Worthington Pump and Machinery Corporation, at its meeting of January 15th, 1947, elected S. Riley Williams Vice President in Charge of Foreign Business.

Mr. Williams joined the Worthington organization in 1920, immediately following his release from the United States Army, where he served as a First Lieutenant in World War I. From 1920 until 1941 he resided in Europe, where he was successively Managing Director of the Worthington Associated Company in Spain, of its Associated Company in France, and General European Manager. In 1941 he returned to the United States, and during the recent war served as Assistant to the Vice President in Charge of Operations. In May 1945 he was appointed Director of International Business.

In his new capacity he will have responsibility for the sale of Worthington products for export, as well as the administration of Worthington Associated Companies in South America and Europe. He will make his headquarters at the Worthington Home Office in Harrison, New Jersey.

"Cleveland's Outstanding Young Man of the Year"

Dr. H. B. Osborne

AT a recent banquet held by the Cleveland Junior Chamber of Commerce Dr. H. B. Osborne Jr., Sales Manager of the Ohio Crankshaft Company, was named "Cleveland's Outstanding Young Man of the Year." Dr. Osborne joined the Ohio Crankshaft Company in 1939 after several years of study and research at Lehigh University with the Chemical and Metallurgical Engineering Department. In 1940 he assumed charge of Sales Development and Research of the "Tocco" Division and in 1942 was made Director of Research. On July 1, 1946, he was named Sales Manager.

Dr. Osborne is a member of an impressive list of Technical and Educational societies, holding offices in several. In addition to his business and fraternal duties he is active in civic affairs in Cleveland, serving in his church as a trustee and also acting as Vice-President of the Cleveland Heights School Board.

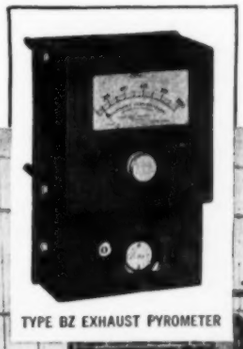
Products Listed In New Sun Folder

IN a new four-page folder, the Sun Oil Company describes its complete line of industrial petroleum products and provides a quick and ready reference for nearly fifty separate products. Divided into groups which include industrial oil, industrial greases, metal working oils, processing oils, and motor products, the special application of each product is easily noted. Of special interest to Diesel users are the *Solnus*, *Ocnus*, and *Dynavis* oils which the company have developed to meet Diesel requirements. The folder, #A-1430 10M 12-46 is available by writing the Sun Oil Company, Industrial Products Dept., Philadelphia 3, Pa.

Another municipal plant

uses *Alnor* EXHAUST PYROMETERS

This Fairbanks-Morse Diesel generator set is one of several serving a prosperous midwest town. As is so frequent in well equipped and well managed power plants, you will find Alnor Exhaust Pyrometers on the instrument board. These reliable pyrometers allow an easy check of exhaust temperatures for maintaining smooth, efficient engine operation. There is an Alnor Pyrometer of the right size for any engine, large or small. Write for bulletin with complete description.



TYPE BZ EXHAUST PYROMETER

ILLINOIS TESTING LABORATORIES, INC.
420 N. LA SALLE STREET • CHICAGO 10, ILLINOIS

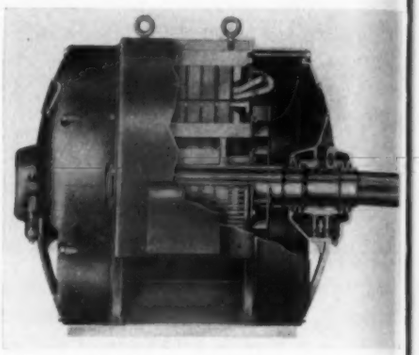
Synchro-Start Engine Controls Now Available

SYNCHRO-START automatic engine controls, virtually unobtainable during the war, are now available in quantity to all manufacturers, distributors, dealers and users of gas, gasoline and Diesel engines.

The complete standard controls line includes: full automatic starting, stopping and protecting systems, over-speed governors, solenoids, automatic cranking units, safety stop controls with indicating signals, heavy duty starting motor contactors, relays, and multiple engine panel boards.

The new automotive lines include automatic starting and transmission controls for trucks, buses, motor cars and power boats. Electronic controls, developed during the War, are offered this year to the general industrial market on a "custom-built" basis. Many interesting new Synchro-Start applications have been developed during the last few years. Of especial interest are automatic engine-driven fire pumps, an automatic pump system for clearing flooded underpasses, and multiple engine-generator installations which automatically start and stop additional engines according to load demand. Write Synchro-Start Products Co., 1064 W. Fullerton Ave., Chicago 14, Illinois.

New "Heavy Duty" Squirrel-Cage Induction Motors



New E-M squirrel cage induction motor.

NEWLY available "heavy-duty" squirrel-cage induction motors for large-power drives from 100 to 1000 hp., 1800 rpm. and lower speeds, answer industry's demand for motors designed for drip- and splash-proof construction.

Fabricated steel frame shuts out falling particles, makes operation quieter, invites easy cleaning. Inspection and blowing out is simplified on larger ratings with access plates designed for speedy removal, replacement. Sealed bearings can be cleaned and refilled without motor disassembly. Double end ventilation is provided by a blower on each end of the rotor. Starting characteristics are NEMA Class B (normal torque, low starting current), for across-the-line starting.

A die-cut 4-page folder, Publication No. 188, is available. Write the Electric Machinery Mfg. Company, Minneapolis 13, Minnesota.

Sutton Named by Borg Warner

THE appointment of Donn Sutton, former newspaper syndicate editor and war correspondent, as public relations counselor for the Borg-Warner Corporation was announced recently by C. S. Davis, President.

Mr. Sutton was editor-in-chief of NEA Service, Scripps-Howard's world-wide newspaper feature organization, with his office in New York. During the war he went on several tours of duty as a correspondent in Europe and the Mediterranean theatre.

PERFORMANCE
PROVES SOUND ENGINEERING OF LINK-BELT CHAIN DRIVES•

Link-Belt Silverlink Roller Chain overhead camshaft drive. Link-Belt Silverstreak Silent Chain Drive operates the water pump. There is a correct Link-Belt chain for every application.

The trend of design in modern Diesel engines has been strongly influenced by the distinctive qualities of such important basic elements as Link-Belt silent and roller chain for camshaft, generator, fuel pump, water pump, governor drives, etc. These efficient, dependable and durable drives represent the accumulated knowledge of more than 70 years of pioneering in development and application of chain to every power transmission purpose. Link-Belt has worked together with designers, builders and operators of Diesel engines from the beginning, and Link-Belt engineers have contributed many basic ideas now employed by builders of internal combustion engines.

Call Link-Belt engine specialists for aid in every phase of chain application.

Two Link-Belt Silverstreak Silent Chains driving overhead camshaft on Joshua Hendy Series 20 Diesel Engine. L-B Duplex Type chain used on lower sprocket. Again, the correct chain for the application.

LINK-BELT Diesel CHAIN DRIVES
SILENT AND ROLLER TYPES

LINK-BELT COMPANY
Detroit 4, Indianapolis 6, Chicago 9, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices in Principal Cities. 10,197

Federal-Mogul Appoints T. J. Marshall

E. O. JONES, vice president and director of sales of Federal-Mogul Corporation, has announced the appointment of Thomas J. Marshall as assistant sales manager.

Thomas J. Marshall

Mr. Marshall joined Federal-Mogul in 1930 in an advertising capacity and became advertising and sales promotion manager of the company. As assistant sales manager he will continue to direct the corporation's advertising. He studied engineering at University of West Virginia and University of Illinois, and was previously connected with D'Arcy Advertising Company, Inc., St. Louis. He is a member of the Society of Automotive Engineers and is widely known in industrial advertising circles.

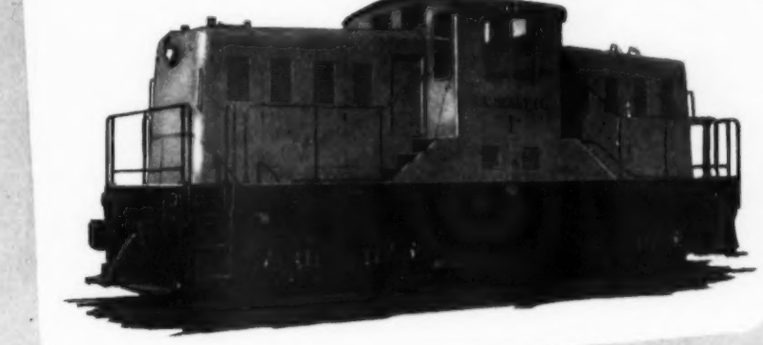
Engineering Firm Expands

Left to Right: Front Row: R. E. McDonnell, C. A. Smith; Back Row: C. K. Mathews, E. J. Thomson, R. H. McDonnell, A. F. Hartung, R. G. Kincaid, R. L. Baldwin.

BURNS & McDONNELL Engineering Company, in their 49th year of Consulting Engineering work, have enlarged their firm membership from the present four members—R. E. McDonnell, C. A. Smith, R. L. Baldwin, and R. H. McDonnell—to eight. The four new members were selected from the Senior Associate Engineers and are:

Arthur F. Hartung, Electrical Engineer, graduate of the University of Kansas, member of the American Institute of Electrical Engineers; Russell G. Kincaid, Civil and Hydraulic Engineer, graduate of the University of Missouri, member of the American Society of Civil Engineers; C. Kelsey Mathews, Civil Engineer, graduate of the University of Kansas, served three years as instructor in Civil Engineering at the University of Illinois, member of the American Society of Civil Engineers; Earl J. Thomson, Electrical Engineer, graduate of Manitoba and Marquette universities, member of the American Society of Civil Engineers.

IF YOU HAVEN'T ORDERED YOUR COPY OF THE LATEST DIESEL ENGINE CATALOG, VOL. 11, BETTER DO IT TODAY, SEE Page 72.



if you designed your next locomotive wouldn't it look like this one?

Pleasing proportions, graceful lines or massive beauty are not the basic reasons why Whitcomb Locomotives are so much in demand for intra-plant hauling and switching. But these characteristics are not objectionable, especially when beneath the good looking exterior you'll find the finest Diesel power plants and electrical equipment that engineers have yet developed. Two powerful engines, conservatively rated, generators, traction motors, radiators, every part functioning perfectly in close coordination with the other parts to form a perfect whole. And finally when the WHITCOMB name plate is placed on the side you can be sure there is no finer locomotive for its weight on the rails.

The economies made possible by definite savings in operating and maintenance costs will, within a few years, reduce the purchase price to the point where you will no longer be paying for a locomotive—but making a profit on one.

You may be interested in the new 1947 illustrated bulletins describing Whitcomb Locomotives—Diesel mechanical and Diesel electric from 3 to 80 tons—write for complete set.

THE WHITCOMB LOCOMOTIVE CO.

BLW THE BALDWIN GROUP

PARK & PROGRESS STS., ROCHELLE, ILL.

SUBSIDIARY OF THE BALDWIN LOCOMOTIVE WORKS

UNITED STATES GAUGE

Tomorrow's accuracy is here today in the new U. S. Supergauge. Get complete information about this superb instrument now.

DIVISION OF AMERICAN MACHINE AND METALS, INC., SELLERSVILLE, PENNA.
Manufacturers of Pressure, Temperature, Flow and Electrical Measuring Instruments

USG

MISOL

THE MILLER DIESEL FUEL ADDITIVE

THIS STARTLING NEW DISCOVERY GIVES YOU CLEAN FUEL SYSTEMS AND PEAK EFFICIENCY FROM TANK TO COMBUSTION CHAMBER.

SAFE AND ECONOMICAL

Descriptive Literature and full information on request

MILLER MANUFACTURING CO.
1100-1110 NORTH 32ND STREET CAMDEN, N. J.

Self-Flaring Tube Fitting

Uniflare Tube Fitting

DEVELOPMENT of a new two-piece, completely self-flaring tube fitting, which may be applied to many varieties of tubing, was announced recently by the Brockway Company. The new fitting, known as the Uniflare, embodies all the advantages of both compression fittings and flared fittings, with none of the usual disadvantages of either. It may be used effectively with tubing of various metals, including copper, aluminum, monel, plastic, "Bundyweld" and other varieties of steel, within a wide range of wall thickness. The fitting is made in sizes from ⅛ inch to ¾ inch.

Plain end tubing is inserted in the fitting and made up in the conventional manner. The tube is self-extruded and self-flared by simple wrench action during the makeup. The fitting is so designed that the nut, body and thrust collar combine to produce the same smooth positive action as an extrusion press—the thrust collar shearing from the nut when wrench pressure is applied. Write The Brockway Co., Naugatuck, Conn., for further information.

International Harvester Advises Speedy Freight Handling

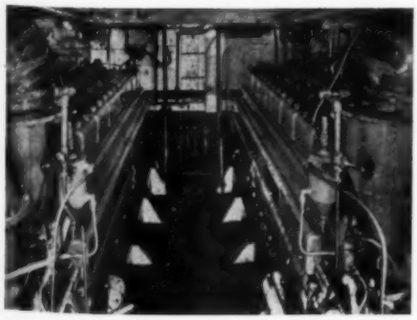
THE International Harvester Company in a recent radio program cited the need for speedy handling of freight by industry to permit the greatest use of freight car and truck space. International Harvester is making every effort to ease this transportation crisis by unloading every freight car and truck promptly on arrival at plants and branch offices, thus making such space available for other shippers.

U. S. Coast Guard Converts to Diesel

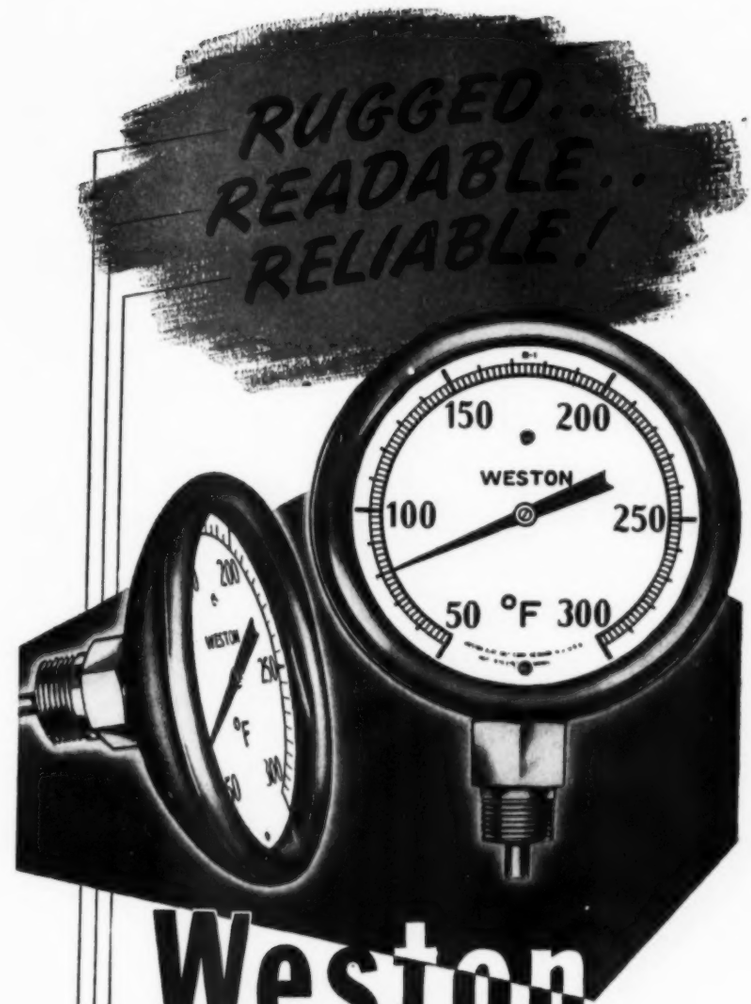
TO increase cruising range, to improve general operating efficiency plus effecting a reduction in fuel cost, the United States Coast Guard has converted the 83 foot offshore Patrol Boat CGC624 from gasoline to Diesel propulsion. Twin Sterling Viking Supercharged Diesels were selected for the repowering job. With the new Viking Diesels, cruising range of the patrol boat is increased threefold. The Diesels consume only 0.4 pounds of fuel per H.P. per hour as against the 0.5 to 0.7 pounds consumed by the gasoline engines.

Several hundred patrol boats of the CGC624 type, powered with twin Sterling Viking gasoline engines, were constructed for the U. S. Coast Guard during the war. Many of these have since been sold to civilian owners. The United States Coast Guard has made an initial installation of two of these engines and many civilian owners are now planning to repower their boats. This reconversion is relatively simple because Sterling Viking gasoline and Diesel engines are practically identical in physical dimensions. The Sterling Viking Diesels selected to power these craft are 8 cylinder 660 horsepower supercharged engines with 8" bore and 9" stroke, an engine that is commonly used to power commercial boats and large pleasure craft.

The 83 foot U. S. Coast Guard Offshore Patrol Boat CGC624 which has been converted from gasoline to Diesel power with a pair of Sterling Viking engines.



View looking forward in the engine room of the CGC624 showing the twin Sterling Viking Supercharged Diesel 8 cylinder, 660 horsepower engines with 8" bore and 9" stroke selected by the U. S. Coast Guard to repower its gasoline-driven patrol boats.



Weston
All Metal
THERMOMETERS

- RUGGED—All metal construction withstands mechanical abuse encountered in the field.
- READABLE—Large dial-type scales readable in a jiffy, even from a distance.
- RELIABLE—No gases, liquids—no capillary connections; stays accurate far longer.

Available from stock for most industrial applications. If your jobber cannot supply you, see your local WESTON representative, or write . . . Weston Electrical Instrument Corporation, 579 Frelinghuysen Avenue, Newark 5, New Jersey.

MAX-MIN-Models—also available with auxiliary red index which indicates maximum or minimum temperature reached since last setting.

WESTON *Instruments*

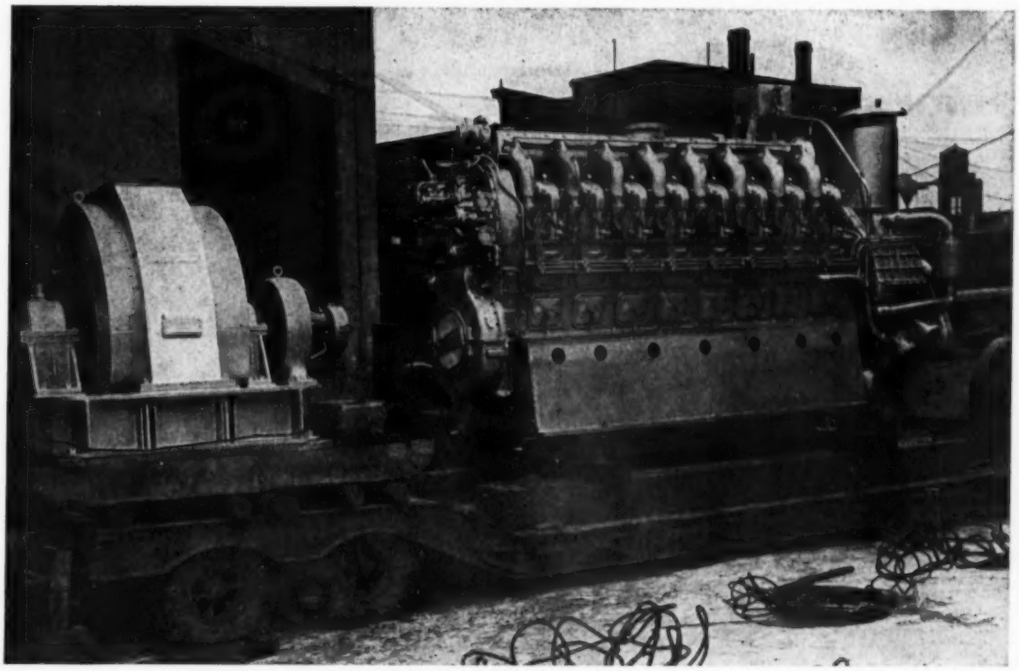
POWER PROTECTED BY PUROLATOR

Purolators have a world-wide record of superior oil filtration on every kind of Diesel—under every oper ating condition—are the choice of both manufacturers and operators. There are more Purolator Diesel Oil Filters in use today than all other makes combined.

PUROLATOR PRODUCTS, INC., NEWARK 2, NEW JERSEY
IN CANADA: PUROLATOR PRODUCTS (CANADA) LTD., WINDSOR, ONTARIO

KEEP OIL FREE FROM ABRASIVES WITH
PUROLATOR
THE OIL FILTER

ENGINEERED
AGSCO
DIESEL POWER



ANOTHER **AGSCO** REBUILT DIESEL GENERATOR BEING LOADED FROM OUR JERSEY CITY SHOPS FOR SHIPMENT TO A WESTERN UTILITY

DIESEL GENERATORS ALTERNATING CURRENT

KVA	MAKE	HP	MODEL	RPM	YEAR
2-1875	Fairbanks Morse	2000	33E16	300	1939
1-1250	Nelseco	1500	6M1-53	300	1931
4-1250	Fairbanks Morse	1700	38D8⅛	720	1944
12-1250	General Motors	1600	16-278-A	720	1944
3-1000	Fairbanks Morse	1250	38D⅛	600	1944
1- 625	Superior	750	OS	327	1938
1- 312	Enterprise	450	D8G-8	450	New
1- 300	Fairbanks Morse	360	YVA	257	1928
1- 250	General Motors	300	8-268-A	900	New
4- 250	General Motors	400	8-268-A	1200	1945
6- 125	General Motors	200	3-268-A	1200	1944
1- 94	Buckeye	112	E	400	1936
4- 75	General Motors	90	6061E	1200	New
13- 62	International	75	UD18	1200	New
8- 37	General Motors	45	3-71	1200	New
15- 18	International	30	UD6	1200	New

AG SCHOONMAKER CO. INC.
50 CHURCH STREET, N. Y. 7, NEW YORK
CABLE ADDRESS AGSCHOMACH PHONE WO 2-7225

As advertised in TIME and NEWSWEEK

Clean air gives the iron horse a better brake

YOU WOULDN'T THINK a big, burly locomotive would be fussy about the air that slams on its brakes. But actually, tiny dirt particles or droplets of oil and water in the braking air can interfere with proper stopping. That's why hundreds of locomotives are equipped with filters and oil separators developed especially by Air-Maze to keep brake mechanisms clean and efficient.

WHICH PROVES AGAIN—you can't take air for granted! Air is tricky, temperamental. It doesn't follow any set rules of behavior. Wherever air is used, it takes *experience* to get good results. At Air-Maze, we've built our reputation on air—by designing cleanable, all-metal filters that make air do a better job for a wide variety of products of which these are typical:

MARINE ENGINES—Filter reduces backfire danger.

COMPRESSORS—Filter keeps out dust and dirt—with negligible effect on air delivery.

GEAR CASES—Filter enables case to breathe without "inhaling" dirt.

EVAPORATIVE CONDENSERS—Filter removes entrained water from air stream.

DIESELS—Filter-silencer minimizes objectionable intake noise.

ELECTRONIC EQUIPMENT—Filter takes dust and grit out of cooling air.

INDUSTRIAL FURNACES—Filter keeps jets clean by removing particles from incoming air.

HAVE YOU A FILTERING PROBLEM? It may be nothing like those mentioned here—but whatever it is, put it up to Air-Maze, the Filter Engineers. Whether you build or use engines, compressors, air-conditioning equipment, *or any device using air or liquids*—the chances are there is an Air-Maze *engineered* filter to serve you better. Write Air-Maze Corporation, Cleveland 5, Ohio.

AIR-MAZE

The Filter Engineers

DIESEL FERRY *TIDES*

To meet the steadily growing traffic across the Narrows between Brooklyn and Staten Island another modern, welded steel ferry boat was launched recently at the Jacobson Shipyards, Oyster Bay, Long Island, N. Y. *The Tides* is a vessel of 690 tons displacement, and will carry 750 foot-passengers and 50 motor vehicles. She is as fireproof as it is possible to make a ship, meeting all Coast Guard regulations for her classification. She is General Motors Diesel-engined and the installation is a beautifully engineered job, worked out in detail by Eads Johnson, naval architect, in collaboration with the technical staff of the Cleveland Diesel Engine Division under the direction of George W. Codrington, vice president and general manager. *The Tides* is the seventh Diesel-electric ferry boat powered by General Motors for Electric Ferries, Inc.

In an engine room of 40 feet by 18 feet 6 inches floor width and 23 feet between trusses there are installed two main Diesel engines of 800 bhp. each, which are coupled to 544 kw. electric generators, and turn at speeds varying from 700 to 800 rpm. according to operating conditions. One propeller shaft runs the length of the hull and is driven through reduction gears at 160-200 rpm. by twin 675 bhp. electric motors that turn at 700 to 875 rpm. The propellers, one at either end, are made of bronze and are right and left handed, respectively. This power set-up gives *The Tides* a speed of 12.8 knots, or 8 knots when only one engine is in operation.

Over the upper deck at each end of the ferry are the usual pilot houses where the captain has complete control of the main machinery by finger tip electric mechanism without recourse to signalling down to the engine room staff. However, the propelling machinery control can be shifted to local control in the engine room if desired. Steering of the ship is by means of a small lever alongside the engine controls in the pilot houses, the large hand wheel being for emergency use only.

The Tides has an overall length of 185 ft., a breadth of 54 ft., a depth of 15½ ft., and a loaded draft of 9 ft. 6 in. Her Cleveland Diesels are of the V-design, 8-cylinder, 2-cycle type, model 8-278A. Because of their short overall length these engines make a very compact installation even with the generators coupled at the forward end, and allow of ample free space in the small engine room.

It is expected that when *The Tides* is shortly placed in service she will equal the fine operating record of her sister ferry, *The Narrows*, which took up her duties between Brooklyn and Staten Island last summer.

"The Tides," 1600 hp. Diesel ferry, just after she had been launched at Oyster Bay, N. Y.

Voran Joins Parker Appliance Corp.

APPOINTMENT of S. E. "Tony" Voran as advertising manager of The Parker Appliance Company, Cleveland, was recently announced by D. W. Holmes, general sales manager. The Parker firm is a major manufacturer of tube couplings and valves for a wide variety of fluid system applications.

S. E. "Tony" Voran

Voran is a graduate of the University of Kansas where he was editor-in-chief of the University Daily Kansan. After a number of years in advertising work with the Capper Publications, Inc., he became advertising manager of Pesco Products Co., a division of Borg-Warner and more recently was an account executive with Fuller & Smith & Ross advertising agency.

Precision Gage Blocks

THE George Scherr Co., Inc., announced recently a new series of measuring instruments capable of checking dimensions to within eight millionths of an inch. These "Ultra-Chex" Precision Length Standards enable the establishment of a reliable system of size control, through the accurate checking of micrometer and other measuring tools, such as sine bars, comparators and snap gages. The lapping of these blocks is so fine that when they are placed together, surface adhesion holds them fast. As many as seven of these blocks can be wrung together to produce any desired dimension. Two of the Scherr gage block sets are furnished with an Optical Parallel which enables the determination of the planeness of the blocks themselves. This ingenious method is based on the theory of light waves and shows by color any aberrations of the plane surface and enables the determination of the magnitude of the flaw.

Write George Scherr Co., Inc., 200 Lafayette Street, New York 12, N. Y.

Fulton Sylphon Appoints J. O. Tragard Eastern Regional Sales Manager

J. O. Tragard

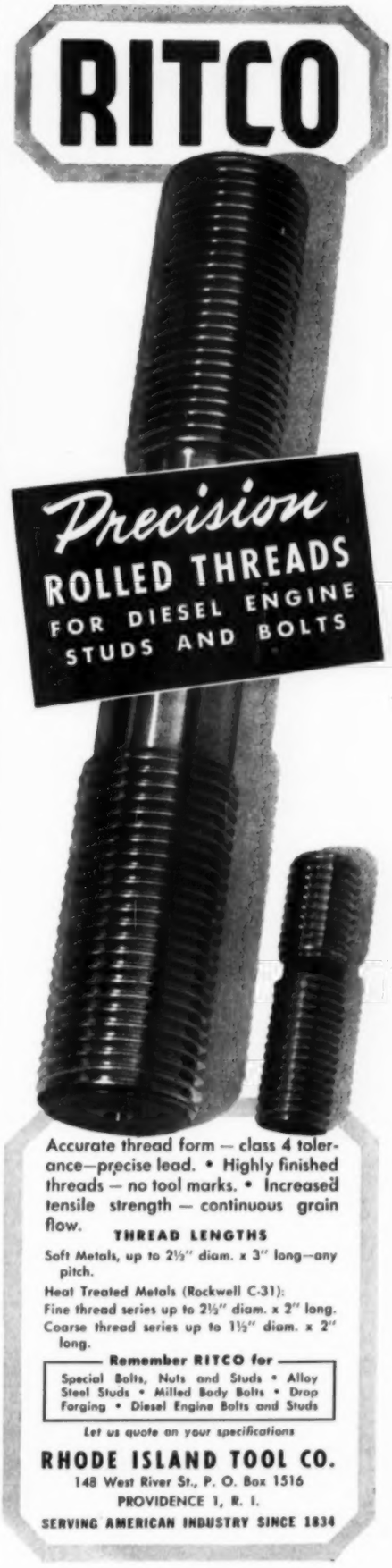
JOHN O. TRAGARD was recently appointed Eastern Regional Sales Manager of The Fulton Sylphon Company, according to an announcement by Fulton Sylphon management. His new duties include supervision of the territory north of Richmond, Va., and from the Atlantic seaboard west to Buffalo, N. Y.

Following his graduation from Harvard College, Mr. Tragard joined the Foxboro Company sales department, engaged in sales and sales promotion work, and functioned as assistant sales manager. During World War II, he served in a number of industry and governmental capacities. He was Chairman of the War Problems Committee . . . Industrial Instrument Industry . . . and served in several other connected agencies.

On January 1st, 1947, Mr. Tragard joined Fulton Sylphon as Eastern Regional Sales Manager and after one month at Knoxville plant, established headquarters in Reynolds Metals Building at 19 E. 47th St., New York City.

Lincoln Electric Announces Office Changes

THE Lincoln Electric Company, Cleveland, Ohio, announced new locations of its branch offices in San Francisco, Los Angeles and Birmingham. The new location of the San Francisco office and warehouse is at 1302 Stanford Avenue, Emeryville 8, California. The Los Angeles office and warehouse is now located at district office has its new location at 113 North 1500 Calzona Street, P. O. Box 7336, Station L, Ninth Street, Birmingham.



Accurate thread form — class 4 tolerance—precise lead. • Highly finished threads — no tool marks. • Increased tensile strength — continuous grain flow.

THREAD LENGTHS

Soft Metals, up to 2½" diam. x 3" long—any pitch.

Heat Treated Metals (Rockwell C-31):

Fine thread series up to 2½" diam. x 2" long.

Coarse thread series up to 1½" diam. x 2" long.

Remember RITCO for

Special Bolts, Nuts and Studs • Alloy Steel Studs • Milled Body Bolts • Drop Forging • Diesel Engine Bolts and Studs

Let us quote on your specifications

RHODE ISLAND TOOL CO.

148 West River St., P. O. Box 1516

PROVIDENCE 1, R. I.

SERVING AMERICAN INDUSTRY SINCE 1834

WHETHER YOU BUILD OR OPERATE AUTOMOTIVE DIESELS...

IT PAYS TO SPECIFY

SEALED POWER PISTON RINGS

SEALED POWER CORPORATION

Muskegon, Michigan • Stratford, Ontario

Keep Your War Bonds!—Get $4 for $3!

FOR ORIGINAL EQUIPMENT... Sealed Power products have long been the choice of leading Diesel engine builders in truck, tractor and equipment fields.

FOR REPLACEMENT... Sealed Power motor parts for Diesel engine needs are supplied by leading distributors throughout America.

SEALED POWER LEADS FIELD... Whether you build or operate automotive Diesels, Sealed Power offers you the full resources of the industry's finest laboratories, a top-flight engineering staff, and facilities and craftsmanship at the head of the field.

SEALED POWER PISTON RINGS

PISTONS · CYLINDER SLEEVES

Hudson Transit CALLS OUR "BLUFF"

Old ideas die hard. It's difficult for many fleet operators to appreciate what really CLEAN oil can mean in engine performance, because THEY NEVER HAD CLEAN OIL, and they can think of it only in terms of partly-cleaned oil—which is as different as the difference between fresh-from-the-cow (infected) milk, and pasteurized milk . . . Like many another, Mr. Bruning, here, couldn't believe the DeLuxe "claims"; he decided to "call our bluff". He's a hundred-per cent-er now, like anybody who gives DeLuxe a trial. Isn't it about time YOU "called our bluff"? WHAT'S STOPPING YOU? . . . DELUXE PRODUCTS CORP., 1416 Lake Street, La Porte, Indiana.

All 15 Winners Were DeLuxe-Equipped

It is no accident that in the last Nat'l Bus Transp. Awards for Maintenance Efficiency, ALL 15 of the 15 winners were DeLuxe-Equipped . . . BIG THINGS are happening in lubrication! WRITE! Get FREE DeLuxe booklet.

DELUXE* *Oil Filter*

DOES MORE THAN STRAIN OIL . . . MORE THAN FILTER OIL
ACTUALLY CLEANSES OIL

*Trade Mark Reg. U. S. Pat. Off.

1938

PREVENT POWER FAILURE

* *Install "U. S." Stand-by Electric Plants*

"U. S." builds a complete line of Diesel and Gasoline-powered Electric Plants... ½KW to 125 KW — A. C. and D. C.

Write for information.

U. S. MOTORS CORP.
542 Nebraska Street
OSHKOSH, WISCONSIN

Highest Quality Gaskets & Oil Seals

by **FITZGERALD**

Gasket Craftsmen for 41 Years

Gaskets of all types and materials to give reliable service under all Diesel operating conditions.

For full information write—

THE FITZGERALD MANUFACTURING COMPANY
TORRINGTON, CONN.

Branches: Chicago, Illinois; Los Angeles, California
Canadian FITZGERALD, Limited, Toronto

FITZGERALD
SINCE 1906 GASKETS

New Twin Disc Hydraulic Couplings

A new series of Small Hydraulic Couplings for use with induction motors and small internal combustion engines was announced recently by the Twin Disc Clutch Company. The six Couplings in the new series have various ratings, ranging from one to 25 horsepower, at 1,800 rpm.

Roger DeLong, Sales Manager, Hydraulic Division, Twin Disc Clutch Company, points out the following advantages to be gained by using Hydraulic Couplings with induction motors and small internal combustion engines:

They assure smooth acceleration, prevent stalling, allow the engine or motor to be fitted to actual running requirements, eliminate the need for shear pins and similar "break-and-replace" protection for driven parts, distribute the load on multiple engine or motor drives, permit the reversing of electric motors at full-load speed without high current surges, and, in case of a standard motor, permit the motor to start under no load and thus makes high torque available for starting.

All but the smallest of this new line of Hydraulic Couplings retain in their design the customary Twin Disc double circuit, which consists of two sets of blades on both the driving and driven members of the Coupling. This design permits the greatest horsepower capacity per inch of coupling diameter and, at the same time, produces a hydraulically balanced unit.

Both the impeller, or driving member, and the runner, or driven member, are lightweight aluminum castings. A cast iron insert forms the hub of the driven member, taking the drive to the output shaft. Stamped steel core rings in both the impeller and the runner form the hydraulic circuit.

The unit is assembled by installing the runners and then merely screwing together the impellers with a rubber or coprene ring gasket to insure against leakage.

For further information write the Twin Disc Clutch Company, Rockford, Illinois.

10 Diesel Locomotives Ordered by Norfolk & Southern

THE Baldwin Locomotive Works recently received an order for ten 1500 hp. Diesel-electric road freight locomotives from the Norfolk and Southern Railroad.

Double Seal Check Valve

Gritproof Check Valve

A NEW check valve developed by Mansfield & Green combines a unique, but simple, double seal which completely eliminates leakage and loss of pressure even with grit in the system. With grit .010 in. in diameter the valves show no leakage or seepage at any pressure to 10,000 psi.

This double seal principle utilizes a metal to metal seat plus a resilient rubber or synthetic rubber ring seal on the check valve poppet. The line pressure forces the resilient ring to the metal seat which force increases with increase of pressure resulting in greater sealing force at higher pressures.

Available sizes range from ⅛ in. to 1 in. SPT, for pressures to 10,000 psi., and any media not destructive to rubber or synthetic rubber.

Dravo To Build Diesel Towboats For Standard of New Jersey

DRAVO Corporation, Pittsburgh, has been awarded a contract to build two 2000 hp., twin screw, Diesel-propelled towboats for the Standard Oil Company of New Jersey. The new boats, each 166 ft. x 36 ft. x 10 ft. 6 in. in size, will be used by Standard in the lower Mississippi River trade.

James H. Gallaway

JAMES H. GALLAWAY, district manager for the Heavy Machinery Division of Nordberg Manufacturing Company, died February 21 after a short illness. Jim, as he was familiarly known to his many friends, represented Nordberg for more than ten years throughout the Mid-west in the sale of Diesel engines. Only recently had he reopened the Nordberg Kansas City office which had been closed during the war. A regular attendant at annual conferences of the Oil and Gas Power Division of A.S.M.E., Jim also served on the Sub-Committee on Oil Engine Power Costs and was ever a source of help and inspiration to that organization. His host of friends and associates share a deep sense of loss at Jim's passing.

New Hilco Filter

THE Hilliard Corporation recently announced a new line of lubricating, fuel and industrial oil filters. These units are constructed of steel and utilize from one to eighteen filter cartridges, measuring 7¼ in. x 18 in. This size which has become so popular with Diesel engine operators is known as the "Navy Type."

Hilco model HFC-8 filter without heater.

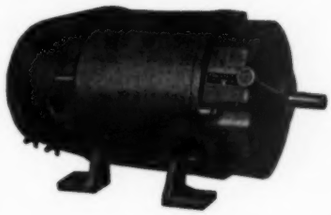
These Hilco Hyflow oil filter units are available with or without heaters, dependent upon the requirements of the user. The oil is delivered to the inlet of the filter and is forced from the outside of the filter cartridge toward the center and then out through the outlet back to the system, either by means of an auxiliary motor driven pump set or directly from engine or equipment pressure. Hilco units may be operated as by-pass or full-flow filters, depending on the flow rate required. Filter elements available for use in these units are made of Hiltex-Cellulose, a highly efficient grade of filtering material, to handle the additive type oils; or Hilite-Fullers earth for handling straight run mineral oils. Micronic filtration and high flow rates at relatively low pressures are claimed for these units.

Bulletin No. F-154, describing these units in detail, is available from The Hilliard Corporation, 102 W. 4th Street, Elmira, N. Y.

Baldwin to Build Gas Turbine Locomotive for Santa Fe

PLANS were announced recently for the construction, this year, of an oil-fired gas turbine driven locomotive. According to an announcement by F. G. Gurley, President of the Santa Fe Railroad, The Baldwin Locomotive Works, the Elliott Company, and the Santa Fe Railroad, working in conjunction, have completed design plans which have been in work since 1945 and construction of the locomotive is to begin soon at the Baldwin plant. Specifications of the locomotive call for a 4-8-4 wheel arrangement. It will be approximately 77 feet long and weigh about 500,000 lbs. The unit is expected to develop 3,000 hp. and will be capable of speeds in excess of 100 mph.

GENERATORS AC and DC



Well-known for their rugged design, efficient performance, long life and minimum maintenance, whether powered by electric, gasoline, or Diesel equipment. Backed by over ½ century of manufacturing and designing experience, Kurz and Root generators are now serving industries throughout the world.

Illustrated are AC generators, only 2 of the many different types developed and designed to fit specific needs and applications. (upper left) two-bearing self-excited type; (lower right) two-bearing, direct connected exciter type.

DC generator (left) two - bearings, self excited type Can also be furnished with direct connected exciter. Both AC and DC generators can be furnished in the single bearing, flange-mounted type for special mounting requirements. Ball bearing construction is used throughout. Complete data upon request.

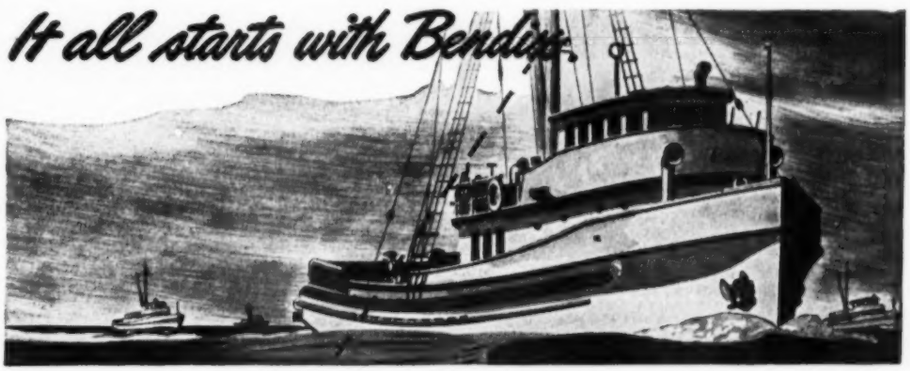
AC-DC GENERATORS

KURZ and ROOT Company Since 1898

APPLETON · WISCONSIN

..... and DC motors and motor generator sets

It all starts with Bendix



Out of touch with land for months at a time, Diesel-powered commercial fishing craft must be "dead sure" of continuous dependable starting.

—and Bendix Starter Drives provide just that.*

Designed and engineered for compactness, ruggedness, universal adaptability, and simplicity of operation, these heavy-duty Drives have a performance-proven record of many years of dependable service on land and sea.

For heavy-duty Starting—marine, automotive and industrial—Bendix is best.

*REG. U. S. PAT. OFF.

Bendix Drive

ECLIPSE MACHINE DIVISION

Division of Bendix Aviation Corporation

ELMIRA, NEW YORK

PRODUCT OF Bendix AVIATION CORPORATION

Better Lubrication

with LESS OIL

10 FEED MODEL
94 LUBRICATOR

● For most efficient lubrication *and* minimum oil consumption specify MANZEL LUBRICATORS. Exactly the right amount of oil metered with clock-like precision.

Manzel engineers will gladly submit recommendations without obligation. Write today.

Manzel Brothers Co. now supplies repair parts for all models of Bowzer and Torrington Lubricators.

A Subsidiary of FRONTIER INDUSTRIES, INC.

Manzel BROTHERS CO.

Builders of HIGH PRESSURE METERING PUMPS Since 1898

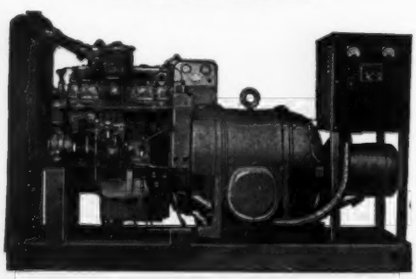
275 BABCOCK STREET, BUFFALO 10, NEW YORK

Generating Units

5 K.W. to 100 K.W. A.C. or D.C.

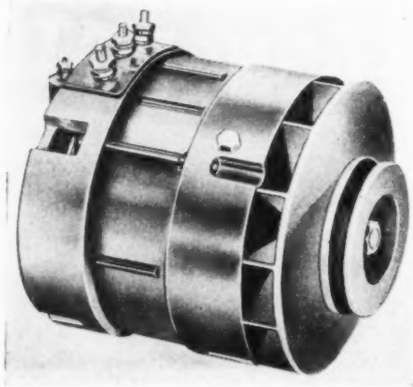
Close regulation of voltage and frequency is an outstanding feature of the generating units we build with either Diesel or gasoline prime movers. We are also equipped to supply any type of instrument panel required.

Manufacturers of engine generator sets for over 20 years.

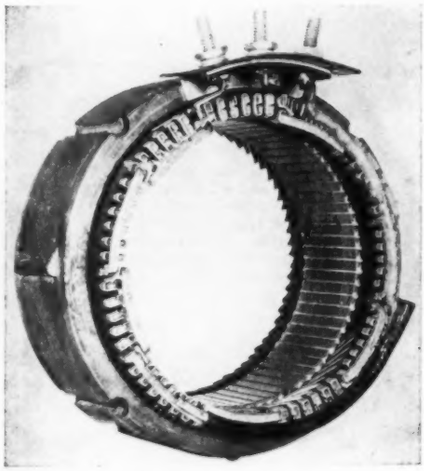


Duplex Truck Co.
Lansing, Michigan

High Output Generator



Alternator used in Leece-Neville system.



3-phase Stator assembly.

A NEW kind of A-C generating system, featuring a new application of an alternator, has been developed by The Leece-Neville Company for six- and 12-volt service on all types of mobile equipment requiring extra-high current output at low and high speeds to maintain batteries.

Chief advantage claimed for the system is its ability to deliver 25 to 35 amperes at engine idle speed and 60 amperes from 12 to 15 miles per hour to top car speed. Based on observation of actual installations and results of laboratory tests, Leece-Neville states that this new generating system can practically eliminate the need for recharging when installed in connection with a battery in A-1 condition.

Consisting of alternator, voltage regulator and rectifier, the system weighs 40 pounds, which is somewhat less than conventional D-C equipment of comparable output. The alternator is of simplified design, having no commutator or rotating armature windings.

The 12-volt version of this new system weighs 42 pounds, which the maker states is 60% less than the weight of comparable D-C equipment. When the correct drive ratio is provided, the 12-volt equipment delivers 100 amperes at engine idle speed as well as at full engine speed. There is no danger of burn-out because the alternator has no commutator. Rotation can be reversed without affecting system connections or performance, and the system can be used for series parallel circuits where 24-volt cranking is required.

On many types of trucks and buses where heavy electrical loads or special operating conditions necessitate high charging at slow speeds, fast speeds, or both, this 12-volt system has already solved numerous battery maintenance problems. Employed on equipment with radio, two-way radio, or the new individual radio-telephone, both six- and 12-volt systems are reported to hold radio noise to an absolute minimum.

Demand for both the six- and 12-volt systems has increased steadily and Leece-Neville reports that production is being expanded as fast as possible.

A new booklet describing the operation of both systems in detail has just been produced and is now available to all on written request to The Leece-Neville Company, Cleveland 14, Ohio.

Book of Certified F&P Flowrator Dimensions Available for Draftsmen

FOR the first time F&P has combined into a single bulletin a complete set of certified dimensions covering every available combination of the popular Series 700 Flowrator instrument (Rotameter).

This book is devoid of all sales information in an effort to reduce to the handiest possible form, comprehensive and accurate dimensional information so important to the piping layout draftsman. Various types of indicating Flowrator instruments, along with panel mounting arrangements, alarm attachments, electrical transmitters, pneumatic transmitters and recorder-controller accessories are included in this engineering composite.

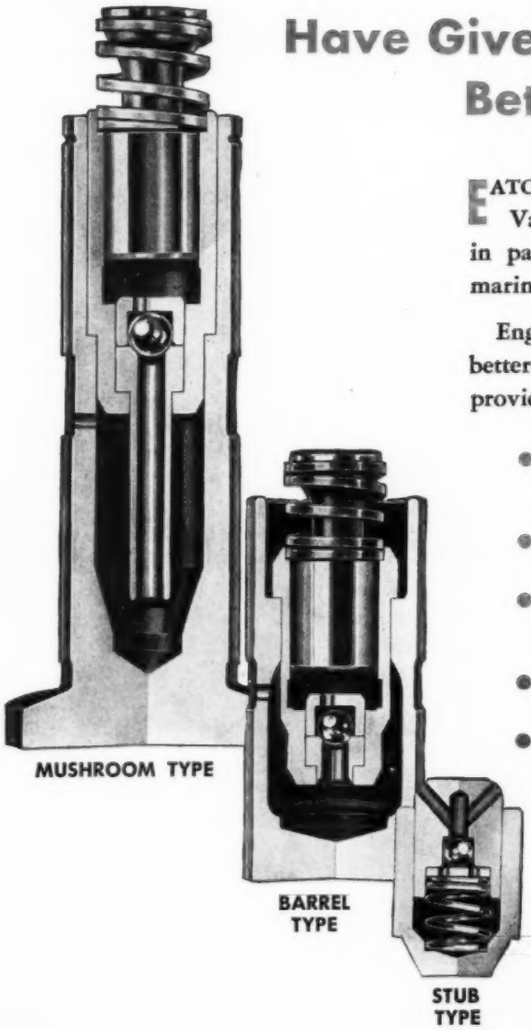
This book is available for limited distribution to all engineers who are called upon to design piping layouts utilizing flowmeter installations. Copies may be had upon request by writing to Fischer & Porter Company, Hatboro, Pennsylvania, Department 5E-A.

Zero-Lash

Registered U.S. Patent Office

HYDRAULIC VALVE ADJUSTERS

Have Given Thousands of Engines Better Performance



EATON has produced many million *Zero-Lash* Hydraulic Valve Adjusters and lash adjuster units for installation in passenger cars, trucks and buses, military vehicles, marine engines and industrial engines.

Engine and vehicle manufacturers recognize the specific betterments which *Zero-Lash* Hydraulic Valve Adjusters provide—

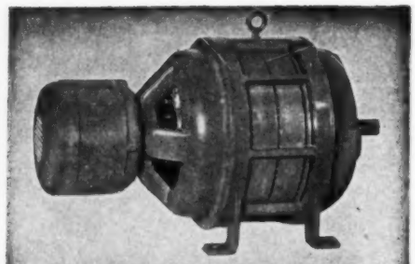
- **Accurate Valve Timing and Perfect Seating at All Engine Speeds and Temperatures.**
- **Longer Life for Valves and Seats.**
- **Freedom from Tappet Adjustments for the Life of the Engine.**
- **Silent Valve Train Operation.**
- **Better Idling at Low Speeds.**

★

Eaton engineers will be glad to discuss the application of Zero-Lash Hydraulic Valve Adjusters to engines now in production or in design.

Zero-Lash Hydraulic Valve Adjusters are available for all types of automotive, aircraft, marine, and industrial engines, both gasoline and Diesel. They are not recommended for installation in individual engines in the field, but only in cooperation with engine manufacturers' engineering departments.

EATON
MANUFACTURING COMPANY
WILCOX-RICH DIVISION
9771 FRENCH ROAD DETROIT 13, MICHIGAN



Columbia A.C. and D.C. Generators are built to meet highest performance standards. Complete range of application, including light, power, ship auxiliaries, or custom designed units.

D.C. UNITS range from 7½ to 200 KW.
A.C. UNITS range from 6¼ to 300 KVA.
Speeds and other specifications to meet requirements. Write for full information.

COLUMBIA ELECTRIC MFG. CO.
4519 Hamilton Ave., N.E., Cleveland 14, Ohio

COLUMBIA
GENERATORS
A.C. and D.C.

The Experience Resulting from 84 Years Devoted Exclusively to the Design and Application of Both Plain Mechanical and Hydraulic Types of Governors Is Available When You

SPECIFY PICKERING FOR YOUR ENGINES

PORTLAND PICKERING CONN.

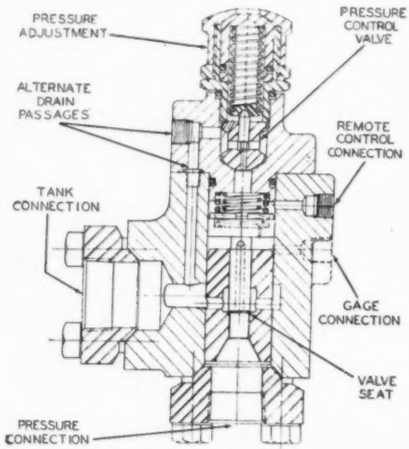
Write for Bulletin

CHECK YOUR FUEL SUPPLY AT A GLANCE

THE LIQUIDOMETER CORP.
36-24 Skillman Ave., Long Island City, N.Y.

Extreme Pressure Relief Valve Announced by Superdraulic

THE Superdraulic Corporation has announced a new 5,000 psi relief valve which is said to eliminate disadvantages of previous designs and incorporate numerous new features. The squealing and chatter characteristic of this type of equipment is said to be completely eliminated. Instantaneous action prevents objectionable pressure peaks. Accurate maintenance of pressure setting is said to be an important feature. Perfect hydraulic balance insures high efficiency and long life. Provision is also made for remote control.



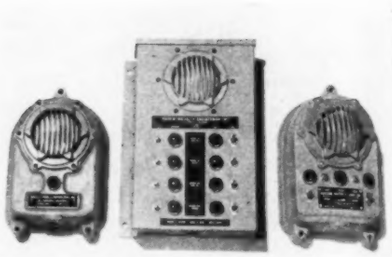
James Hoffer, Superdraulic vice president in charge of engineering and designer of the new relief valve, predicts that this valve will receive an enthusiastic welcome by users of high-pressure hydraulic systems in which relief valves have caused considerable trouble in the past. For complete details write Superdraulic Corporation, Dearborn, Michigan.

New Line of Engine Alarms Announced

PACIFIC Diesel and Engineering, Inc., has recently moved into new plant facilities at 36 Heron Street, San Francisco, California, and has expanded its standard line of alarms to include several new models.

As in the past, PDE handles sales to engine builders directly while retail sales are handled by distributors located in seventeen of the major cities in the United States and Canada and 25 distributors in Central and South America.

The new lines of alarms include two basic series, the 100 and the 1000 series. The 100 Series are designed to give warning of abnormal engine lubricating oil pressure and cooling water temperature. The 1000 Series are adaptable to not only several engines, but also various engine room accessories such as bilge pumps, ice machinery, bait line pumps, etc. These are built in from three to ten circuit models. These new alarms are compact and easy to install. As in previous models, the warning horn, the relays, lights, switches, and terminals are combined in a compact panel box. The 100 Series utilize cast aluminum boxes, the 1000 Series are made of heavy sheet metal.



The new 1000-series, multiple circuit alarm center, flanked by 100-series models.

Literature giving installation drawings, specifications, prices, and installation instructions is available from Pacific Diesel Engineering, Inc.

Write For This Informative Booklet

THE Weatherhead Company has just released an interesting booklet with an entirely new slant entitled "Prospecting For Perfection." It deals with the scientific research and engineering back of this company's operation.

Emphasis is placed upon the importance of engineering, research and development engineering in the success of this company, which manufactures tube fittings and flexible hose assemblies as well as products for the Liquefied Petroleum Gas industry.

Gene P. Robers, Sales Promotion Manager, said in commenting on the booklet: "In this booklet we have tried to convey to the many users of our products, the amount of care and study which goes into the design, testing, and product development of all Weatherhead parts by our designers, engineers, experimental machine shop and laboratories."

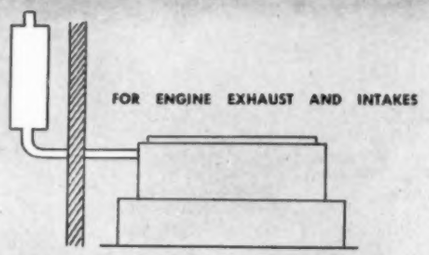
The booklet is 11 in. x 8½ in., 32 pages in two colors, and carries 85 illustrations. Copies may be had upon request by writing to the Sales Promotion Department, The Weatherhead Company, 300 East 131st Street, Cleveland 8, Ohio.

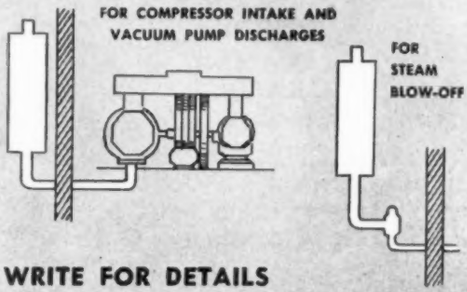
RATOSIGHT
FLOW ALARM

The float in the Ratosight Alarm moves up or down in direct proportion to flow rate changes. At any points you may choose in the flow range it will operate an electrical switch to light an electric lamp, to sound an alarm, or to stop or start electrical equipment. Positive . . . accurate . . . dependable. Cast in all metals from ¾" size and up. Available also without the alarm attachment as a flow rate indicator. Send for Bulletin 92 which gives the interesting details.

FISCHER & PORTER CO.
Dept. 8-5E Hatboro, Pa.

MAXIM SILENCERS





WRITE FOR DETAILS

THE MAXIM SILENCER COMPANY
94 HOMESTEAD AVE., HARTFORD 1, CONN.

H. W. Ramberg, Inc.

37 VAN DYKE ST. BROOKLYN, N. Y.

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Fabricators and Reconditioners of both Domestic and Foreign makes.	Fuel Valves, Pumps, Valve Plungers, and Housings.	Cams and Rollers, Oil Filters, Gears, Injectors, Atomizers and Nozzles.
Telescope Pipes, Governors, Pistons and Lubricators.	H.P., M.P., and L.P. Compressor Valves, Cylinders, Pistons.	Slide, Exhaust, Inlet Starting Valves, Inlet and Exhaust Spindles.

DIESEL SPECIALTIES, INC.

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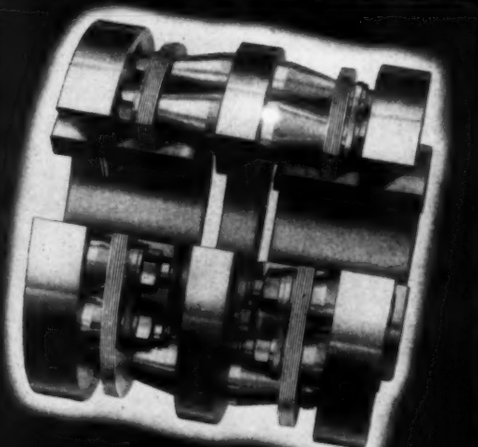

provide for Angular and Parallel Misalignment as well as Free End Float . . .
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WARREN, PENNSYLVANIA

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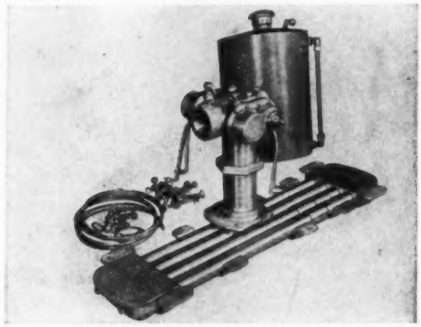

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NEWEST LITERATURE ON REQUEST
G. WALTER MACHINE CO.
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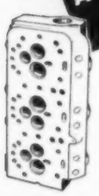
A *Good* DIESEL HEAD FOR A CRACKED ONE— IMMEDIATELY



On hand and ready for shipment — Guth rebuilt diesel heads! An exchange service that reduces delay costs. You get an economical like-new head, repaired by Guth Fusion Process — the perfected method for rebuilding a uniform structure in cast iron or aluminum castings. Write today.

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SAVE MONEY *GENUINE DIESEL PARTS*
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SPRAY TIP AND VALVE ASSEMBLY
Clean, fresh stock. All brand new.

Gm No.	Gm Name	List
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5227318	VALVE STOPS	.40
5227210	VALVE SPRINGS	.50
5227317	SPRAY TIP 7 HOLE .006 155° TYPE O	2.75
5227325	Complete Assembly	6.90

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FOR QUANTITY PRICES!
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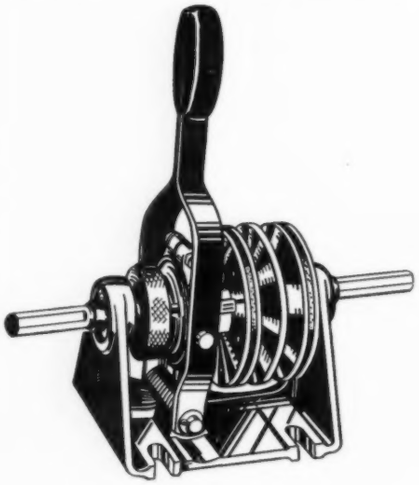
DIESEL PARTS SPECIALISTS
1329 SOUTH MICHIGAN AVE., CHICAGO 5
SAVE 50% or MORE

M-P Package Clutch

MEETING demand from the industrial and marine fields, the Marine Products Co., 515 Lycaste Ave., Detroit, Michigan announces a new "packaged clutch" for a wide variety of applications. This versatile clutch permits a varied number of drive combinations and consists of a clutch assembly which is self contained in a bracket. A double extension shaft as well as a double groove pulley between the clutch face plates provides various drive arrangements.



New self-contained clutch.

The clutch can be either direct connected or V-belt driven from any source of power available. If the clutch is direct connected to a source of power, both the extension shaft and the double groove pulley can be used to drive separate accessories. If the clutch is V-belt driven from its source of power, the two extension shafts can be used to drive accessories. It is applicable to both marine and industrial installations where various accessories must be operated through a clutch drive.

Miller Appointed Vice President By Weston

WESTON Electrical Instrument Corporation, Newark, N. J., announced recently the appointment of John H. Miller as Vice President and Chief Engineer. He succeeds W. N. Goodwin, Jr., who, although retired, has been retained as an engineering consultant.

Mr. Miller brings to his new position a background rich in training, broad experience, and noteworthy accomplishments. A licensed professional engineer in New Jersey, Fellow of the A.I.E.E., and Senior Member of the I.R.E., Mr. Miller has been credited with thirty United States patents, and several in Canada and Great Britain.

Kelite Announces New Parts Cleaner

A NEW parts cleaner has been developed by Kelite Products, Inc., which is claimed to be very effective in removing carbon deposits from Diesel engine parts. This product, Formula 555, contains no phenolic compound and has a very high flash point. It is harmless to all metals. The new cleaner requires no heat to effect cleaning and is protected against evaporation by a built-in seal.

For further information write the Kelite Products, Inc., Box 2917—Terminal Annex, Los Angeles 54, California.

Continental Engineering Appoints Stuart D. Brown

CONTINENTAL Engineering Corporation, 30 Church Street, New York 7, N. Y., announces the appointment of Stuart D. Brown as Pittsburgh Sales Representative. Mr. Brown will handle the sales of manual and power operated watertight bulkhead doors, ship's windows and portlights and other marine specialties. Mr. Brown's headquarters are at 624 Poia Road, Edgeworth Boro., Sewickley, Pa.

Stuart D. Brown

A native of New London, Conn., Mr. Brown was educated in mechanical engineering at the Stevens Institute of Technology. In 1924, he joined the Marine Department of the Babcock and Wilcox Company as Sales Engineer. Mr. Brown left B. & W. in 1935 to become Sales Manager of the Engineering Works Division of the Dravo Corporation where he remained until 1946. In September of that year, Mr. Brown established his own business as Manufacturer's Agent and Ship Broker.

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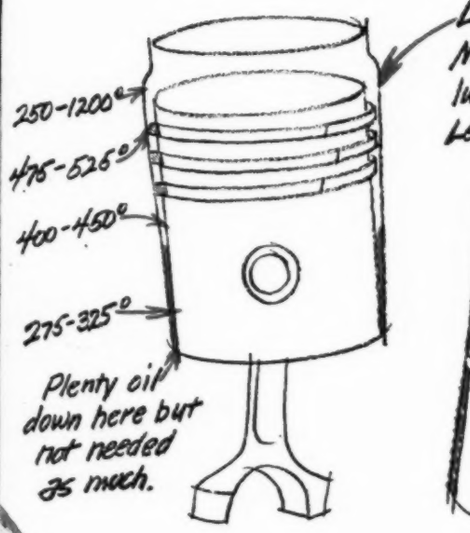
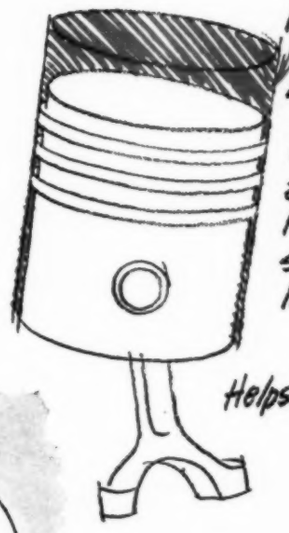
LUBE MEMO

Idea for preventing tapered cylinders!



Liners wear tapered like this— Most wear at top because ordinary lube oil scoots off hot metal, Leaves top of barrels bare.

Plenty oil down here but not needed as much.



RPM DELO DIESEL ENGINE LUBRICATING OIL stops this kind of wear. Contains adhering agent which hugs hot metal surfaces most oils leave bare.

Helps prevent blowby.

DIESEL ENGINE RPM DELO LUBRICATING OIL

Call representative Today

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THE CALIFORNIA COMPANY • Denver, Colo. THE CALIFORNIA OIL COMPANY • New York

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Engines & Coaches Easily

When you wash your Diesel engines and coaches, use built-for-the-job Oakite Composition No. 70. Energetic detergent action of this specialized Oakite material thoroughly removes stubborn, oily road film, and other surface-marring dirt. Quickly produces clean, streak-free surfaces without harming finishes.

Further details, yours for the asking. Write TODAY!

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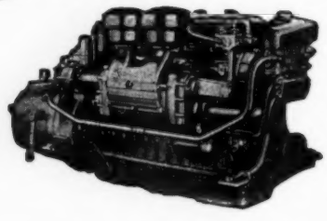

GRAY MARINE DIESEL ENGINES

Model 6-71—165 to 225 H.P.; two cycle; fresh water cooled. 12 volt generator and starter. Price includes 2:1; 2.5:1 Twin Disc type clutch or Borg-Warner transmission.

Price to Dealers Lots of 3	Consumer Price
$1400	$1750

Wire, write or phone MAin 4-5181

Benjamin's for Motors
130 CLINTON STREET
BROOKLYN 2, NEW YORK
MAIN 4-5181

Bowser Announces New Filters

TEN sizes in three new models of expendable cartridge filters are in production at Bowser, Inc., as announced recently by Fred S. Ehrman, general sales manager. The new type filter contains new, replaceable, resin-impregnated, cellulose elements which remove particles as small as 1 micron (.000039 inch) from liquids with viscosities up to 600 S.S.U. and temperatures as high as 350° F. The cellulose cartridges are completely neutral, contain no chemical bleach and will not remove additives or inhibitors, or affect the color of the filtered liquid except by the reduction or removal of foreign matter.

Larger models have proved effective in airport, railway, Diesel and bulk plant installations for Diesel fuel, lube oil, gasoline and other petroleum products. Write Bowser, Inc., Fort Wayne, Indiana, for further information.

How Used Is Used?

WOULD you believe a used Diesel Engine is as good or better than a new one — — — In most cases, we wouldn't expect you to believe that, but there is one company proving it is true!

Benjamins For Motors, 130 Clinton St., Brooklyn, N. Y., has bought several hundred Gray-marine Diesel Engines, the Popular 6-71 Models which were used in government landing barges. These engines were used for only 50 hours or less and were practically new . . . But Benjamin's had every one moved to their huge repair shop and there, using factory trained personnel and factory parts, they rebuilt every machine like new. Then they tested and proved what they claim—that these engines all performed like new or better—that is why Benjamin's guarantees them just as they do their New Gray-marines—the only difference being the great savings in price at $1750 to consumers, $1400 to dealers—nothing more need be said.

Those interested write, wire or call Benjamin's for Motors, 130 Clinton St., Brooklyn, Main 4-5181.—Advt.

H. P. Bish Appointed Assistant Manager, Federal & Marine Divisions of General Electric

H. P. Bish

H. P. BISH has been appointed assistant manager of the Federal & Marine Diviisons of the General Electric Company, according to a recent announcement by R. S. Neblett, manager of the Divisions.

In May 1943 Mr. Bish was appointed assistant to the manager of the Federal & Marine Divisions, in charge of administrative affairs, and actively participated in settling all War Contract Terminations for G-E's Apparatus Department. Mr. Bish represents the General Electric Company on the Ship-builders Council of America and is active on sub-committees of the Navy Industrial Association.

Smith Heads Stewart and Stevenson Wichita Falls Branch

F. W. Smith, Diesel Engineer for Stewart & Stevenson Services, has been appointed sales representative for the company's Wichita Falls offices, which were opened recently to serve northwest Texas with engineered power employing General Motors Diesel Engines and Continental Red Seal Gasoline Engines, it was announced by Joe Manning, general manager of the company. Mr. Smith, who will reside with his family in Wichita Falls, has a long and successful record with Stewart & Stevenson Services in the capacity of power engineer and formerly was assistant manager of the Dallas sales offices of the company.

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Inexpensive INSURANCE for expensive CRANKSHAFTS

Bearings of Alcoa Aluminum Are Bearing Metal Through and Through

Alcoa Aluminum provides high performance bearing alloys for the heavy-duty requirements of diesel service.

Longer life, high resistance to fatigue, corrosion resistance that permits use of additive oils, high heat transfer that prevents localized "hot spots"—these are the basic advantages of Alcoa Aluminum bearing alloys. Alcoa makes them available in sound, friction-free, nonscoring bearings that are bearing metal through and through.

Ask your builder to make *bearings of Alcoa Aluminum* "standard equipment" on your engines.

ALUMINUM COMPANY OF AMERICA, 2141 Gulf Bldg., Pittsburgh 19, Pa. Sales offices in principal cities.

MORE people want MORE aluminum for MORE uses than ever

ALCOA ALUMINUM

IN EVERY COMMERCIAL FORM

New DIESELS

Immediate DELIVERY

ENGINE GENERATORS

300 KW COOPER BESSEMER 230 D.C.
300 KW FAIRBANKS MORSE 3 PH.
150 KW CHICAGO PNEUMATIC
150 KW CUMMINS
100 KW SUPERIOR, D/C, 230/110
100 KW HERCULES 3/50—60/220—440
50 KW CUMMINS 3/60/240
50 KW INTERNATIONAL 3/60/240
50 KW SUPERIOR, AC, 3 PH.
40 KW HERCULES, DC, 115 V. MARINE
30 KW INTERNATIONAL, 3 PH.
30 KW HERCULES, 220, 3 PH.
30 KW BUDA LANOVA 50/60 CYC.
30 KW CATERPILLAR 3 PH.
15 KW HERCULES, 110/220, PH.
15 KW INTERNATIONAL
15 KW WAUKESHA
10 KW HERCULES, DC, 115

INDUSTRIAL ENGINES

300 HP SUPERIOR
200 HP MURPHY 6 CYL.
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12 HP WITTE
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6 HP WITTE

MARINE ENGINES

300 HP SUPERIOR
165 HP GENERAL MOTORS 2:1, or 2.5:1, or 1:1.25
165 HP MURRAY & TREGURTHA
120 HP BUDA 2:1
125 HP HERCULES 1.5:1

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PETROMETER CORPORATION
5 STAR SQUARE, LONG ISLAND CITY, N. Y.

Standard Practices

. . . . *Continued from page 56* . . . .

The starting air system consists of an air compressor with a driving motor or engine, air-storage tankage, pressure gage, relief valve and piping to the engine or engines.

For small plants a gasoline engine-driven or dual drive compressor is favored for the reason that starting air pressure can be restored with no engines running. Larger plants often rely on a motor-driven compressor, sometimes with automatic stop and start control by pressure switch, or may have both engine-driven and motor-driven units.

The compressor may be of either single- or multi-stage type and air or water cooled, depending upon the size and duty. The discharge air pressure depends upon the requirements of the engine served, and since designed starting air pressures differ, the compressor should not be selected before a decision is made on the make of Diesel engine.

The cubic footage that should be installed in storage tanks will depend upon the starting pressure, the number of starts required without recharging the tanks, the number of engines in the plant and the size of the largest engine. At least two receivers should be supplied in each station. The engine builder should be consulted for his recommendation on this point. Starting air tanks should be made in accordance with the Rules for Construction of Unfired Pressure Vessels, Section 8, American Society of Mechanical Engineers Boiler Construction Code. If there are state or local ordinances applying to such tanks, the buyer should furnish the engine builder with full details. Starting air tanks should be installed with conveniently located drains to remove condensed moisture.

MODERN DIESEL-GENERATING UNIT FOR SALE

Fairbanks-Morse Model 33D12 600 HP. 400 RPM, 6-cylinder, Diesel engine direct connected to 415 KW, 519 KVA, 3 phase, 60 cycle, 2400 volt generator with direct connected exciter. Being removed from regular light plant service to make room for larger unit, can be seen in operation all time. Available about July 1, 1947. For further details contact,

H. V. ZAHM, City Manager
OBERLIN, OHIO

General Electric Control System

IN the March issue of DIESEL PROGRESS the control system of the new Alco-G. E. locomotive was discussed. Not specifically mentioned was the General Electric Company as the manufacturer of this new electro-hydraulic governing system. In addition to its utility for locomotive installation, it can be adapted for ship propulsion and power plant use.

Combination Stud Driver and Puller

DRIVING or pulling studs by gripping as little as ½ in. of the unthreaded body of the stud is featured by a new combination stud driver and puller.

This production stud setting tool, made by Titan Tool Company, is placed over the stud to be set or removed and requires only a slight left or right hand turn to effect a grip on the stud. When the chuck of the tool is lowered over a stud, the upper end of the stud contacts an adjustable stop screw. This automatically elevates the core and brings the rolls into centralized contact to the cam surfaces in the driving member and stud. When rotation is stopped the tool may be lifted off the stud without reversing the direction of rotation. Write the Titan Tool Co., Fairview, Pa., for further information.

IF YOU HAVEN'T ORDERED YOUR COPY OF THE LATEST DIESEL ENGINE CATALOG, VOL. 11, BETTER DO IT TODAY, SEE Page 72.

Research Laboratory For B-W Superchargers

THE completion of highly modern research laboratories and the addition of new machine tool equipment to facilitate the production of B-W Superchargers in the Pesco Products Division of Borg-Warner Corp., in Cleveland, was recently announced by C. S. Davis, Borg-Warner President.

"The Pesco engineering staff is concentrating at present on developing superchargers for heavy duty gasoline engines for trucks, buses and other industrial uses," Mr. Davis said. "In addition, there is extensive research on superchargers for small, high-speed Diesel engines and for the engines of light pleasure planes. Though Pesco at present is concentrating its efforts on the production of positive displacement superchargers, other types of superchargers for internal combustion engines also are being developed," said R. J. Minshall, President of the Pesco Products Division.

WEST COAST NEWS ITEMS

By FRED M. BURT

NEW, all-steel, welded, 82 ft. *Neptune,* combination purse seiner and tuna boat, launched by Heo Boat Co., Oakland, now fishing out of San Pedro, has an 18,000 mile cruising range at 11 knots, powered with twin General Motors Diesel engine, 330 hp., 6 cyl., supplied by Bay Cities Equipment Co.

AN almost revolutionary craft is the 28 ft. Diesel-engined speed cruiser *Snooper* of the Royal Vancouver Yacht Club. Conceived by Robt. Q. Maxwell of Simpson-Maxwell, Buda engine distributors in Vancouver, built by Pleasure Craft Boat Works, the *Snooper* is powered with a 6 cyl. 90 hp. Buda.

THE first three of eleven new all-steel trawlers for the green shrimp industry in the Gulf of California, have been delivered by the Avondale Ways, New Orleans; they are driven by MRD-B8, 142 hp., 8 cyl. Superior Diesels.

THE *New Oregon,* 57 ft. purse seiner of the Puget Sound Fleet, owned by Antone Kordich and George Cuculich, Tacoma, has been repowered with a D13000, 115 hp. "Caterpillar" Marine Diesel Engine.

LATEST of a long series of wooden tuna clippers built by Lynch Shipbuilding Co., San Diego, is the *Heroic,* 116 ft. x 27 ft. propulsion-powered with a 600 hp. supercharged Enterprise Diesel; auxiliaries are two 125 hp. Lorimer Diesels, direct-connected to 75 kw. generators.

THE 1000 ton frozen fish plant under construction for Pesquera Iquique, (Chile) is being equipped with American machinery including two 200 hp. Diesel compressor units, and three 50 kw. generators driven by 75 hp. International Diesels. All pumps in the elaborate system of all-brine will be Fairbanks-Morse.

THE new 106 ft. steel tuna clipper *Jenita,* built by National Iron Wks., San Diego, designed by G. Bruce Newby, for San Diego Packing Co., is propelled by an Atlas-Imperial super-charged Diesel engine of 530 hp. Auxiliaries are a pair of Atlas, 112 hp. Diesels, direct-connected to 92 kva. generators.

THE new 35 ft. x 11 ft. hook and line boat, *Frankie-Jo,* owned by Vito Pomilia, San Francisco, is powered with a 70 hp. Buda Diesel engine, built by Sausalito Boat Works. The engine is fitted with a Twin Disc front end power take-off for winch operation.

A NEW wooden fantail fishing vessel being built by Joe Romero, San Diego, is 44 ft. long, beam 12 ft. 6 in. and stows 18 tons; powered with a 60 hp. Lorimer Diesel.

FIVE Peterbilt tractors delivered to Navajo Freight Lines (Los Angeles, Denver, etc.) by Los Angeles distributors H-R Truck & Equipment Co. are powered—three with 150 hp. Cummins Diesels, two with 275 hp. Cummins. Another unit, a 200 hp. Cummins Diesel truck was delivered to L.A.-Seattle Motor Express.

PURCHASED as surplus from the Navy, the 77 ft. *Kru* has been converted by Manual Goularte into a luxury vessel for Joe Denni, Wilmington, Calif., yachtsman, powered with a 160 hp. Washington Diesel engine.

A 63 ft. power yacht, designed by Arthur DeFever, under construction by Hodgson-Greene-Haldeman Shipbuilders, Long Beach, with her 180 hp., 6 cyl. Buda Diesel, will have an estimated speed of 12½ knots.

THE 4200 hp. (two Nordbergs and two Busch-Sulzers) of the Arizona Edison Co.'s generating station at Naco, Ariz., has been augmented by the addition of a 2250 hp. Hamilton Diesel engine and a 1400 kw. Westinghouse generator; sale and installation by Beeson Bros. Engineering Co., pioneer Diesel engineering company of Los Angeles.

INCLUDED in the specifications of a new series of steel, refrigerated purse seiners, 100 ft. 6 in. long, to carry 185 tons at 10 degrees F. or lower, are 500 hp. Diesel engines for propulsion power, and two 75 kw. Diesel-generating sets. They will be built by Avondale Marine Ways, New Orleans.

THE new wooden tuna clipper *Lilliana,* from the yard of Lynch Shipbuilding Co., San Diego, 118 ft. by 26 ft. 6 in., is powered with a 550 hp. supercharged Atlas-Imperial Diesel engine with two 120 hp. Atlas Diesels driving 75 kw. G.E. generators, for auxiliaries.

A 104 hp. Buda Diesel direct connected to a 60 kw. Bardco generator to supply power for a refrigeration system, has been installed in the San Pedro purse seiner *Sea Spray,* owned by Chas. Dargivevich.

WITH a 240 hp. Fairbanks-Morse Diesel to give a rated speed of 10 knots and a F.M. 40 hp. Diesel auxiliary, the 72 ft. former Army tug *ST 414* is being prepared by the Hood Bay Salmon Co. for cannery tender service.

Forged Steel Design made to special order for all types and sizes of air and gas compressors—from 2" to 16" diameter.
Valve plates and discs of all designs in alloy steel, stainless steel, monel, bronze and other metals.
Write for estimates and send samples or blueprints of your old valves.

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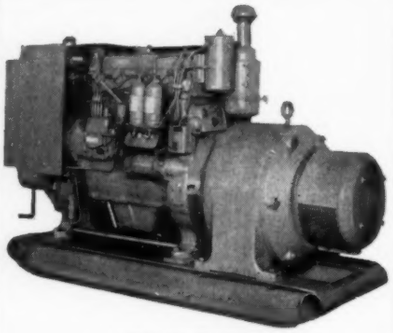

25 KW UNIT 1200 RPM

DIESEL
GENERATOR UNITS

DC and AC; 50 and 60 Cycles

Also compressor and pump units and combinations designed and built to order.

EARLY DELIVERY

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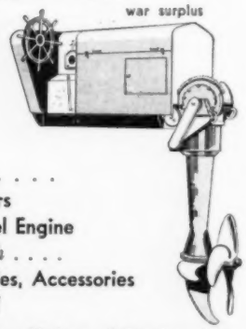
LARGE QUANTITY
BRAND NEW
MURRAY & TREGURTHA
MODEL 0-2D

Outboard propelling units.



Powered by . . . .
General Motors
165 H.P. Diesel Engine
Complete with . . . .
Spares, Batteries, Accessories
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Priced Far Below Value of Engine Alone

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New Clark 350 H.P. Model MD-4 Marine Engine. New and Used Diesel and Gasoline Generators 400 WATT to 50 K.W.

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DEALERS IN MARINE AND INDUSTRIAL ENGINES

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